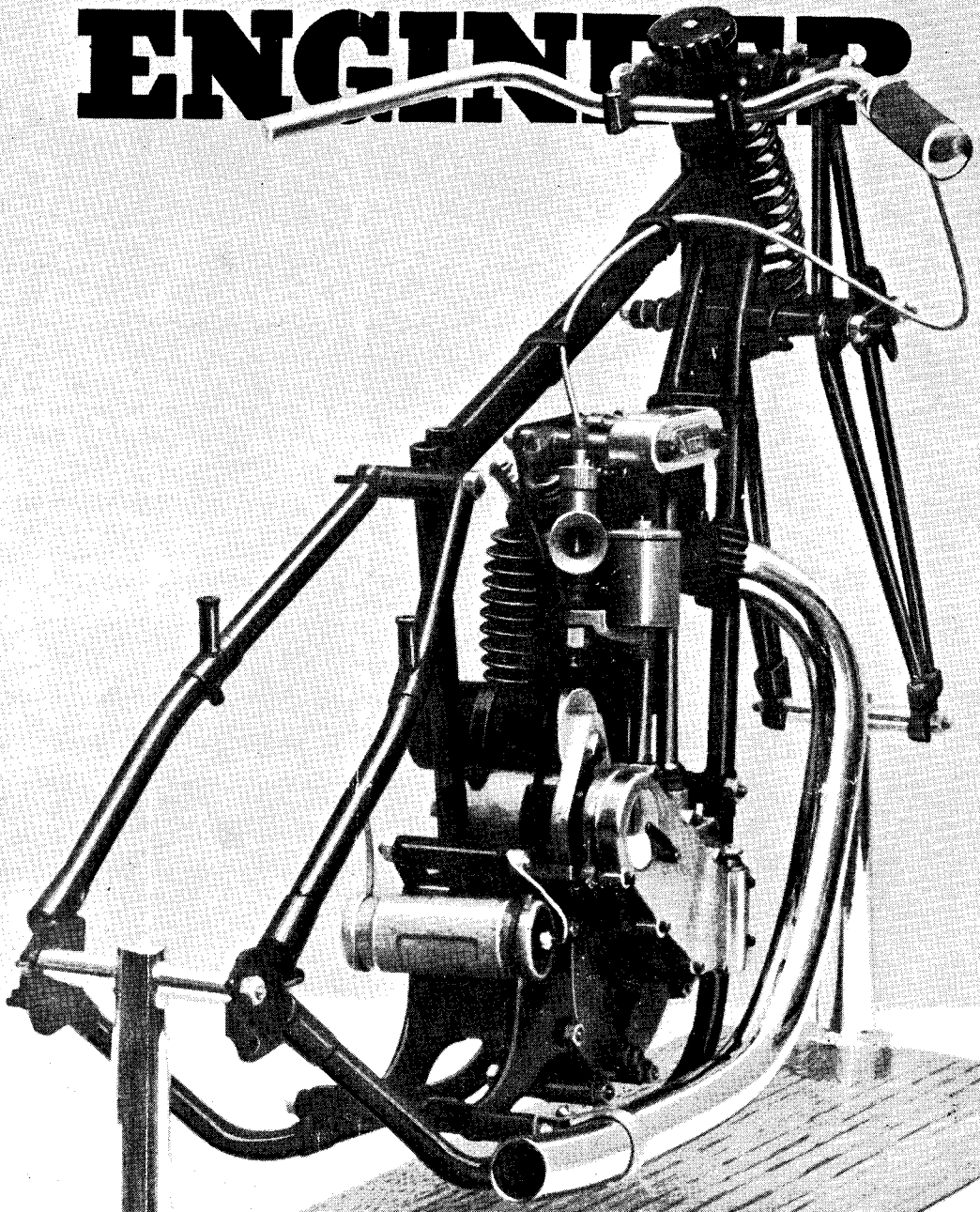
THE MODEL ENGINEER



Vol. 99 No. 2475 THURSDAY OCT 28 1948 9d.

The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

28TH OCTOBER 1948

VOL. 99. NO. 2475

SMOKE RINGS

Our Cover Picture

● THE MODEL seen on our cover this week is a quarter-scale 495-c.c. Stevens motor-cycle built by Mr. G. F. Wills, of London. When finished, it will be fitted with a sidecar. This model in its unfinished state was exhibited in the Competition Section of the "M.E." Exhibition and was awarded the prize of £2 donated by Mr. G. W. Hole for the best model motor-cycle. Mr. Wills made his own patterns and castings for the engine, which, I understand, runs very well; the only part he did not make was the sparking-plug. If Mr. Wills is able to maintain the high standard of workmanship in the rest of the machine as he has in what is already built, I imagine that the finished model will be the finest of its kind in the world.—P.D.

Round-headed Screws

● I SEEM to have precipitated something like an avalanche! In my notes which accompanied the photographs of Mr. Harrison Bacon's marine engine, published in the "M.E." for October 7th last, I commented upon the obtrusiveness of the round-headed screws. If I had left it at that, probably all would have been well; but, as I am one of those curious people who prefer the appearance of hexagon-headed screws and nuts, I added a note to the effect that, no doubt, round-headed screws would be replaced by studs and nuts when the supply position permits. I had temporarily forgotten that, in full-size practice, round-headed screws are almost invariably used for fixing lagging-plates to cylinders. This practice is common to stationary engines, marine engines and outside cylindered locomotives, though, in some cases, cheese-headed, rather than round-headed, screws are used.

I think friend Westbury was the first to remind me of all this; but the many letters which have come in since leave no doubt about it! Therefore, I must correct my former comment and state here that it would be wrong to replace the round-headed screws by anything else. They could, with advantage, be rather smaller, and consequently, less obtrusive; my point is that, in a photograph of a model, minor details tend to become exaggerated, especially if, for any reason, they have to be over-scale in size.

Finally, I would ask all those readers who have written about this subject to accept my grateful thanks for their letters.—J.N.M.

Calling Maghull and District

● A LETTER from Mr. J. Winstanley, 36, Moss Lane, Maghull, Lancs., announces that there is a scheme on foot to form a model engineering society in his area. If any reader is interested in this idea, he is invited to get into touch with Mr. Winstanley at the address given above.

—J.N.M.

A Pioneer from Australia

● A FEW weeks ago, I was informed that a Mr. W. J. Smith had called to see me. Now, there are quite a lot of W. J. Smiths in the world, and the name itself, therefore, had very little significance, but I found that my visitor was none other than the one and only "Belvedere Smith," a very notable figure in the early days of model power boating, whose experiments in the use of small petrol engines for boat propulsion in the early years of this century are now a matter of history. Many years ago, Mr. Smith emigrated to Australia, where he set up a very successful engineering business, specialising mainly in the manufacture of screws. His last visit to this country was a few years before the war and, as on that occasion, he again visited Victoria Park and met many of his old friends.

Mr. Smith still retains a keen interest in model construction, and showed me some photographs of a very fine 4-cylinder engine and gearbox unit, and also some small c.i. engines which he has constructed. He is a prominent member of the Sydney Society of Model Engineers which, he informs me, is in a very flourishing condition, and is unique in having fine headquarters with lecture and meeting halls, locomotive and car tracks, and a power boat pond, permanently available for the use of its members.
—E.T.W.

A Cordial Request from U.S.A.

● OUR PUBLICATIONS MANAGER, the other day, handed me an interesting and friendly letter from America. It came from Mr. Robert A. Jeffries, whose address is Piedmont, Missouri, U.S.A.; he wanted to know if we could inform him of the subscription rates in dollars, as, to quote his own words, "I don't know how I would ever learn the current rate of exchange in this small town of less than twenty-five hundred population which is situated in the heart of the Ozarks." He makes some very complimentary remarks about THE MODEL ENGINEER, and says that he is interested in the operation of models through the use of "live steam," especially railroad models.

But he goes on to say that if he could be of any service to any of our subscribers in Great Britain, he would like to help them. He is interested, in addition to live steam, in electric traction of all kinds and in music, especially classical. He is nineteen years of age and is a Junior at the University of Illinois; he would be interested in corresponding with someone of similar age or older, and with similar interests.

I hope that some readers will act upon this suggestion and write to Mr. Jeffries at the address given above. I know some lasting friendships which have been formed in this way, through the medium of THE MODEL ENGINEER.—J.N.M.

Corrigendum

● I SEEM to have been misinformed about the 7¼-in. gauge passenger-carrying track at the "M.E." Exhibition. A letter from Mr. C. R. L. Coles, Publicity Secretary of the Kodak Recreation Society, informs me that the track was loaned by his society. I tender my apologies for my previous statement, and I am glad to have it corrected.—J.N.M.

L45

● I AM one of those older Londoners who can feel great satisfaction at the news that the London Transport 4-4-0 steam tank engine, No. L45, now withdrawn from service, at the ripe old age of 82, is not to be broken up. This engine is the last survivor of the Beyer, Peacock outside-cylinder 4-4-0 tank engines, no fewer than sixty-six of which formed the most numerous class on the old Metropolitan Railway, prior to 1905. Built in 1866, L45 took her turn in working the normal passenger traffic of the Metropolitan Railway until about 1905, when electrification of the "Met" led rapidly to the discarding of the steam locomotive stock, especially the older engines. However, L45, which was then No. 23 on the Metropolitan Railway, was among the few of her class that were not sold or broken up, but retained for branch-line work, local goods traffic, ballast trains and other odd jobs. In 1935, No. 23 was transferred to the Service Dept. of London Transport and, since then, has been stationed at Lillie Bridge, Brompton, for use in hauling trains of ballast or engineering material about the Underground when track repairs and other engineering works were in hand. She was re-numbered L45 by the Service Dept. and as such she has now been withdrawn from service; but it is good to know that, as the last survivor of a distinctive and well-known type of locomotive, she is to be preserved.—J.N.M.

An Old Model Locomotive

● MR. G. E. C. WEBB has sent in a report of the recent exhibition organised by the Southampton and District Model Engineering Society, and with it he sent two photographs which, unfortunately, are not suitable for reproduction in our pages. I am especially interested in the mention of an old outside-cylindered 2-4-0 tank locomotive named *L'express*, and I am hoping that the society will have this old engine photographed and let me have a description for publication. The chief point of interest is the age of the model; there seems to be no doubt that it dates from about 1870. Large coal-fired, *working* model locomotives as old as this are rare; in fact, the only rival that I can think of is Dr. R. L. Robinson's Midland Railway Kirtley 0-6-0, which is probably somewhere about 70 years old though it was provided with a new boiler and put into proper working order by Frank Baldwin about 15 years ago. If any reader knows of other 70-year-old coal-fired models, I would like to hear from him.—J.N.M.

Evening Classes for Model Engineers

● WE LEARN that the London County Council have organised evening classes for model engineers. These are held at the Kensington Men's Institute, Wornington Road School, Golborne Road, W.10, on Mondays and Thursdays from 7.30 to 9.30 p.m. A class for beginners is also held on Fridays. At the time of writing, there are vacancies in all these classes. For further particulars, applications should be made to the Principal, Mr. C. Bancroft, at the school.—P.D.

BOUQUETS and BRICKBATS

by R. W. Dunn

IN my customary remarks concerning the engineering models in the competition section of THE MODEL ENGINEER Exhibition, I must pay special tribute this year to the outstanding merit of the exhibits at this year's show. At first sight, it was obvious that the quality of the workmanship had gone up by leaps and bounds, even in comparison with last year. I do not think there has ever been, at any of our exhibitions (and that is going back very many years), such a fine four-cylinder locomotive in 1½-in. scale as that shown by Mr. H. C. Powell, of Crewe. His fine L.M.S. 7¼-in. gauge "Duchess of Buccleuch" was quickly adjudged the Locomotive Cup winner, and apart from the quality and mass of work entailed in it, the completeness of detail was exemplary, right down to the refinements of the steam-sanding gear.

Then, again, we had a most excellent locomotive by Mr. F. Cottam, of Greenford, and had it not been for the former locomotive, I think Mr. Cottam's engine would have been well in for the Cup. This was also a four-cylinder locomotive, of the "King" Class, G.W.R., of ¾-in. scale, and was most complete in minute detail, with all the small oil-cans and appliances used by the driver and fireman. This engine created a good deal of interest, and reflects very great credit on the builder, who is right outside the engineering profession.

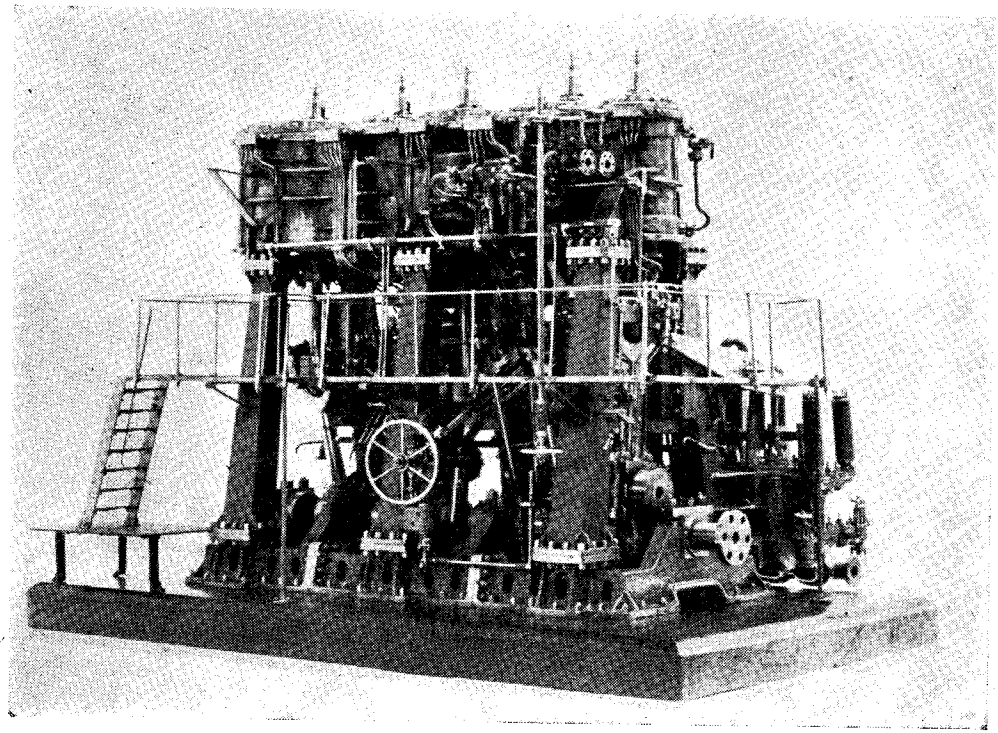


Photo No. 1. A mass of true to scale detail

Passing on to the General Engineering Cup, here again we had a most outstanding model for correctness of scale and fidelity to the prototype. It was won by Mr. J. A. Kay, also of Greenford, for his triple-expansion marine engine and surface condenser with air and circulating pumps. Made to a scale of ⅛ in. to a foot, this engine had a wealth of detail put into it, as can be seen from the photograph of it that appeared on the front cover of the September 2nd issue, and photo No. 1 above. It was a model of the type of marine engine as made by Messrs. Cammell Laird & Company in their engine department, designed for single-screw vessels, the prototype having cylinders 20 in. and 33½ in. and 55 in. by 39 in. stroke. Every time one looked at the model it seemed

there was something fresh to see, and I just contemplated how long it would take to assemble, if it was completely dismantled, and all parts were laid out separately on a table! One would get startling evidence by this means of the enormous amount of work and detail in such a model.

Another marine engine model in this section was Mr. E. B. Wilcox's (Weaverham) compound condensing engine, complete with thrust-block and propeller. This was well executed and much admired, and although a free-lance design, very marine engine entered by Mr. L. Lackie, of Dundee, was shown running during the whole of the period, and caused a great deal of interest amongst the younger generation and beginners. Although not a scale model, and somewhat lacking in fidelity to any prototype, it was certainly a pleasing exhibit in motion to the less technical visitors. A photograph of this model appeared on the front cover of the August 26th issue.

The 1-in. scale horizontal engine by Mr. K. N. Harris showed some interesting points in design,

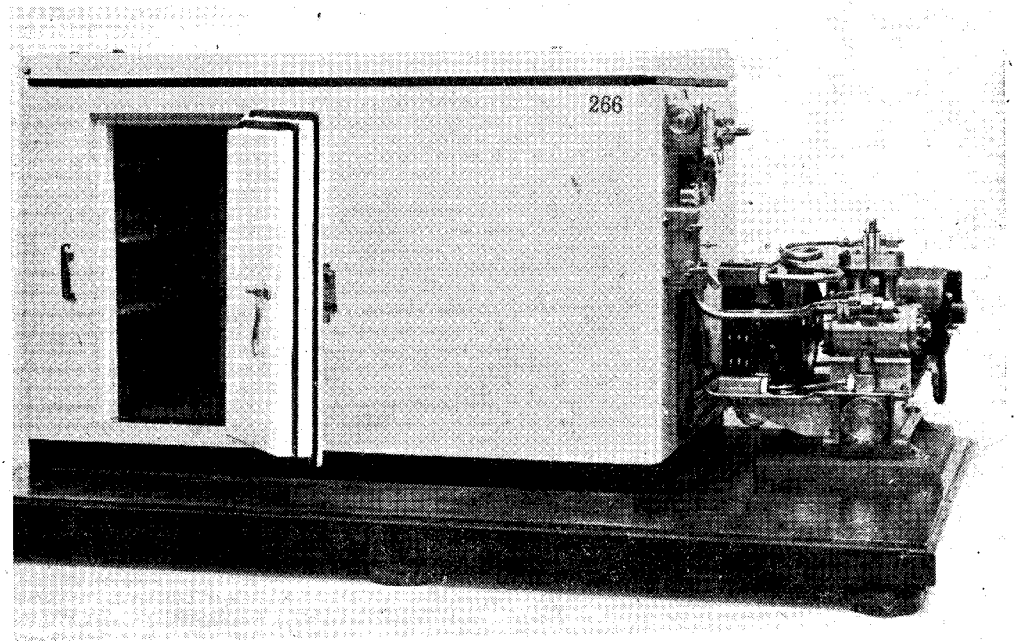


Photo No. 2. A refrigerator with cold room. A utility model

closely followed marine engine practice and true to scale characteristics. This entry deservedly won a Bronze Medal for its good workmanship.

One of the most interesting models was Mr. McCreesh's refrigerator, shown as a commercial cold-room, complete with all fittings, with the methyl-chloride compressor unit and electric motor, on a combined bedplate, and mounted alongside the chamber, made the exhibit a very representative one, as well as a very practical one, because it can be used for domestic purposes, as well as a show piece. As an original exhibit, it well the deserved Bronze Medal, and is depicted in photographs Nos. 2 and 3.

Yet another unusual entry was by Mr. A. F. Winter of an old-time belt-driven steam generating set mounted in the customary tiled engine-room, together with small-scale representative switchboard. The engine was a vertical single-cylinder open type, driving an over-type dynamo fitted with copper brushes, also polished armature protecting shrouds, being very representative of the machine in vogue around the year 1880. Working exhibits in the competition section are seldom in evidence at our shows, but the model and his usual good workmanship gained him a V.H.C. Diploma.

We also had the usual freak, this time in a very small electric motor which weighed about 9 grains, by Mr. W. W. Anderson, of Birmingham. The motor had a *wound armature and field magnet* and was shown at times running on a 2-volt battery, a fan about $\frac{3}{8}$ in. diameter being mounted on one side of the armature, which was about $\frac{1}{8}$ in. diameter. That such things are made by human hands is amazing.

There were some very fine petrol engines, which have been reviewed by Mr. Westbury, but I would like to mention the small i.c. engine entered by Mr. R. L. A. Bell, of Yeovil, which is after the design of Mr. Westbury's road-roller engine, but intended for stationary use. A photograph of this appeared in Mr. Westbury's article on page 265 of September 9th issue. The arresting part of this job was the carefully thought-out additions to the original engine, including the centrifugal governor mounted in the flywheel, the mechanical lubricator, and fuel and scavenging pumps. Many readers, no doubt, would like to make this engine up as a stationary unit, and if

Mr. Bell would give a write-up of the additions he has made as such, I think it would be appreciated. It deservedly obtained a Bronze Medal and Merit prize. Another novel engine now seldom modelled was the hot-air engine by Mr. A. J. Cartwright ; it was quite an unusual design and the work put into it was of a very high-class character. The trouble with engines of this type is that they give such very small power in comparison with their size, which, no doubt, puts many people off making them.

Digressing for a moment to some of the prominent models outside the engineering section, I think one of the most beautiful of the loan exhibits was the "Berkeley Coach," the old four-in-hand London-to-Brighton stage coach. Not only was everything perfect about it, but the attitude of the horses, which were extremely well modelled and painted, was most realistic. I am quite sure that if a photograph of this model was taken, say, ¾-front view, at scale eye level, it could easily be taken for the real thing. Another novelty was a scale model of a caravan, by Mr. F. Lewis, of Bromley, a "Raven" four-berth trailer, which was fitted up with all the modern regalia inside, and electric light, a very neat job which gained him a Silver Medal. Yet another was a scale model of Ixworth Church, made of similar stone to the original, with complete interior pews and bells in the tower capable of chiming, a very painstaking effort by Mr. Landymore. Many other scenic models too numerous to mention were in evidence, but I must not forget to mention the very realistic model of the typical L.N.W.R. station on the outskirts of London, in an industrial setting and all the station approaches, the scale being 3½ mm. to the foot. This gained Messrs. J. K. Nelson and K. Tyler a Silver Medal, and also in this case, if a photograph were taken at a suitable level, it could be taken for a real railway setting.

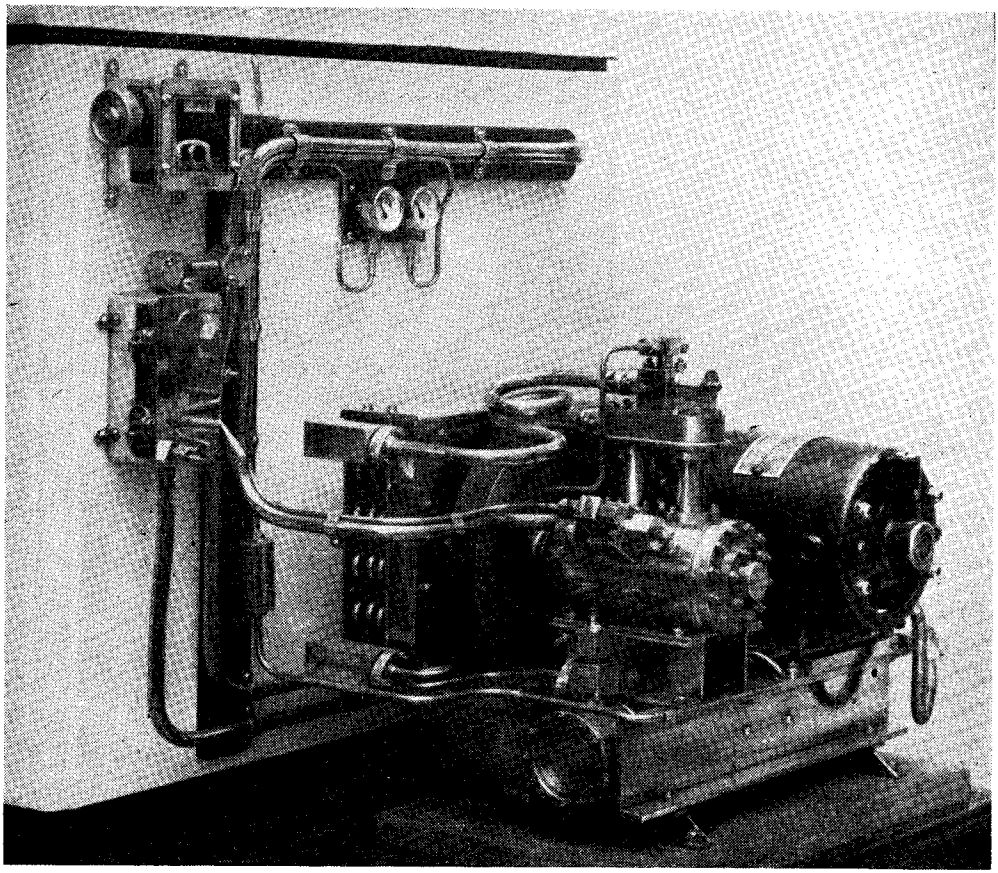


Photo No. 3. A close-up of the refrigerator model, showing the compressor unit and electric motor

A very fine piece of work in the realm of sheet-metal work was shown by Mr. D. L. Butcher, of Kettering, in the hand-beaten miniature set of armour, of the 15th century period. In conversation with the maker, I learnt that when on holiday in Cornwall a few years ago, he made friends with our past contributor on sheet-metal

work, Mr. Dyer, of Mousehole, with the result that Mr. Butcher has become an able student of the art under the tutorship of Mr. Dyer. The exhibit itself, which I remember Mr. Percival Marshall admired last year when the same model was on loan, has proved the mastery of the art which Mr. Butcher has so well accomplished in the skill of sheet-metal working, for which he was duly awarded a Silver Medal.

made in one piece ! Now, in a model the machining of the wheels should be such as to give the appearance that a separate tyre has been fitted, which is quite easy to do while it is being turned. I know of cases, as in Dr. Winter's " Como," where separate tyres have actually been fitted, but usually this is an unnecessary refinement. Failure to represent the appearance of a separate tyre means that the whole character of the

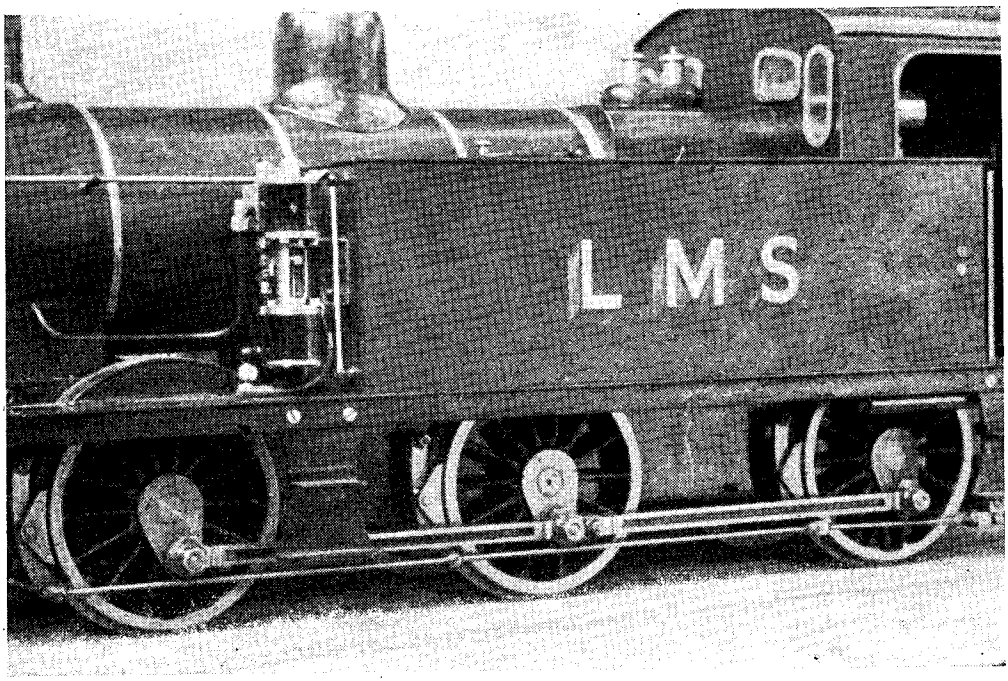
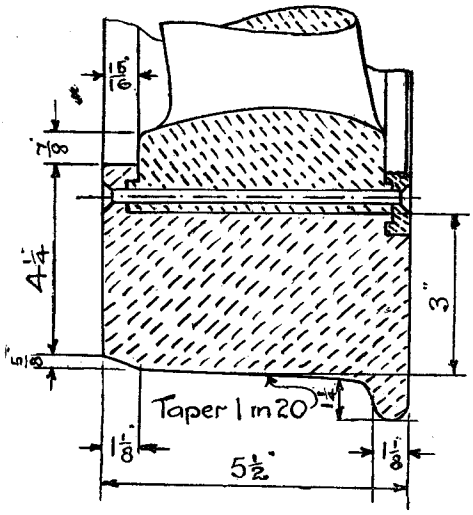


Photo No. 4. Spoilt by misshapen tyres

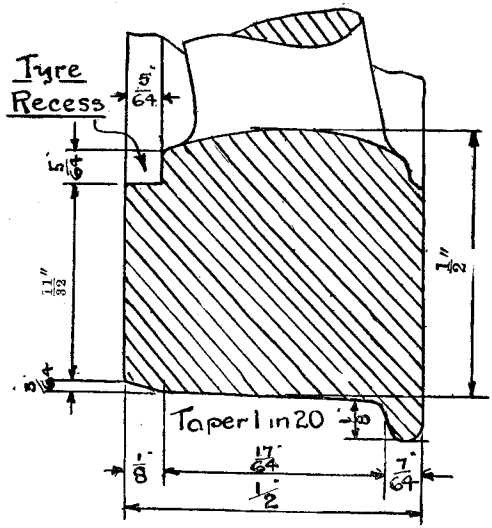
After having said all these words of congratulation and praise for the high standard of workmanship, etc., of the competition exhibits, I would like now to add a few criticisms, which allude mainly to infidelity to the prototype, and may lead some of our aberrant enthusiasts to think again before submitting their work to the eagle eye of the judges ; for I may say that many marks are lost each year to contributors for just the want of a little forethought in the matter of correct design. One point in particular under this heading that I noticed was the incorrect tooling of locomotive tyres. I have on several occasions drawn readers' attention to this error, but in spite of this, it seems many have failed to take notice, and I think I counted only six locomotives out of the whole twenty-three big jobs that could be said to be anything like the correct section of the prototype tyre. It is well known that in full-size practice, the tyre itself is of tougher steel than the wheel centre, and that this tyre is pressed on hydraulically to the steel wheel, thus constituting two entirely separate parts ; but to look at many models it would seem that the maker was of the impression that all wheels were wheel is lost, and in order to assist readers I append a sketch of the section of a full-size tyre, compared with how the makers should represent it. As a particularly bad example of wheel turning, the model of an L.M.S. tank engine entered in the competition section is shown in the accompanying photograph, No. 4, and it is needless to say that the competitor lost a great number of marks due to his inattention to this important detail. It is surprising to me that such blatant errors are not apparent when assembling wheels as those instanced.

A further case of the inaccuracy of the " solid wheel " was seen on quite a large job, in which the maker should have known better, because he was " brought up " in a locomotive works. Other things which offend the eye are that in many cases rivets are far too large in diameter, and pitched too far apart. If this size of riveting is to be adhered to, it would be far better to adopt flush riveting, to mask the out-of-scale proportions. But correct riveting can be made to near-scale proportions, as was witnessed in Mr. Cottam's " King " locomotive.

Then we have the controversy about slotted-



Section of driving wheel of full-size locomotive, after G.E.R. practice



Section of equivalent wheel for a model of 1-in. scale

head screws (which I believe I started) which I have always contended are quite wrong to use in prominent places where normally hexagon nuts or hexagon-head set-screws should have been used. Mr. Williamson has evidently quite lost sight of correct angle of the argument in his recent letter, and he, as well as Mr. Hutton, reminds me of the proverbial dog, barking up the wrong tree. By all means, use slotted screws for the sake of strength in a model, provided they are properly masked from view, and in this case they are most likely to be much above scale proportions ; which brings me to the point that if scale-size slotted-head screws must be used in a model, they would not be much use in strength because they would have to be 12-B.A. or smaller for ¾-in. scale. So Mr. William's argument rather falls to the ground on this score alone. It would be quite ridiculous to use a large number of cheese-headed screws for the sake of scale proportions, if strength is inadequate, to say nothing of the work entailed in drilling and tapping such small holes. I should prefer to put in flush riveting in their stead. If the above two gentlemen also refer to the commonsense letter by Mr. K. N. Harris, in the issue of August 19th, I think they must agree, as I do, that the case as stated has been proved by trial.

An Exhibition at Southampton

ON Saturday, October 2nd, the Southampton and District Model Engineering Society held a one-day exhibition at Lexby Hall, Totton, their third this year. A wide range of models were shown and created a good deal of interest among the visitors. The exhibits included a large number of locomotives, some completed and others in various stages of construction, besides traction engines, beam engines, a gas engine and a cannon, among many other things.

Greatest interest appeared to centre round Mr. Moody's 3½-in. gauge " Coronation Scot " locomotive, *Tremona Court*, which was kept busy all the afternoon on the passenger track down the centre of the hall. This is a large powerful engine, but naturally, the short length of run did not allow it to fully show off its paces. Mr. Bevan's " Petrolea " also did good work on the passenger track, as did club secretary Mr. Barnes' 5-in. gauge saddle tank on a track laid alongside on the floor.

Southampton being so strongly associated with ships, it was not surprising that the marine section was well represented. Both i.c. and flash-steam hydroplanes were shown, together with a variety of models ranging from a steam yacht to a model galleon which will really sail, the latter being the work of the club's youngest member.

Another interesting exhibit was a really old, coal-fired 2-4-0 tank locomotive. This engine was discovered not long ago, buried under a heap a rubbish in a junk yard. A little of its history has been discovered. It was built, it seems, about 1870, and during the 'seventies, it was shown at various exhibitions on the continent. The engine is an " odd " gauge, the wheels fitting comfortably over the outside of the 3½-in. gauge track in the hall! She has outside cylinders and Stephenson's link motion between the frames and carries two brass plates, bearing the impressive name *L'Express*.

The club secretary, Mr. Barnes, is shortly rejoining the forces, so Mrs. Barnes has promised to carry on as secretary during his absence. Southampton will probably be the only club ever to have had a lady secretary.—G. E. C. WEBB.

"FOWLERS"—A CONCERTO FOR TWO

by O.C.T.

FORTUNATELY, I was born with a mentality that simply thrives on, and nearly worships, anything which derives its motion from steam. I use the word "fortunately" because I feel positive that those good folk who favour the i.c. engine cannot possibly experience the exquisite thrill engendered by the sight of a steam engine—working full out—be it locomotive, traction, stationary, or what have you. After all, a diesel looks precisely the same whether the throttle is shut or full open, the only difference being that in the latter state the appalling clatter just about equals the amazing aroma.

After that little preamble I will endeavour to relate, for the benefit of any readers of the steam ilk, the happenings of a wonderful afternoon I spent recently. At the time I was convalescing from a nasty chill, and my wife and I were being taken for a run in the family car. We were somewhere in the Harlow district and, at my suggestion, we turned off the main road and struck into the wilds of rural Essex. Having traversed about half a mile of by-road, I suddenly spotted on the grass verge a large ploughing implement of the kind used by steam ploughing sets. Speed was immediately reduced and a sharp look-out maintained for the two engines which quite possibly should be in the vicinity and, if so, I simply had to find them. Another ¼-mile and there, just past a T-road, was a little caravan of the type usually associated with steam-rollers, etc.

This called for a sudden halt and a closer investigation on foot. In a moment, I found what I was looking for, a wet patch on the road, and in the centre the stones all bare—unmistakably the overflow from an injector; also, the familiar imprint of strakes. We now boarded the car again and followed the trail. (Foxhunting hasn't a thing on this!) It was only a narrow lane and very tortuous. We rounded a bend and there, brother traction fans, was a most glorious sight, two immense Fowlers just arrived, one blowing mightily from his safety-valve. I was out of that car and into another world in a flash. Thoughts of wife, convalescence and manners (I even omitted to say "Shan't be long") just dropped from me like a cloak. At that moment, No. 1 engine emitted a lovely "Tuck-Tuck," and slowly turned into the field; No. 2 followed, and we proceeded to the bottom corner. No. 1 now ambled over to the farther corner dragging the loose cable from No. 2's drum and took up his position parallel to us (No. 2). As the implement which was to be included in the afternoon's programme—a cultivator with about 20 tines—was at our end of the field, we now had to drag the cable from No. 1 and couple the respective ends to the cultivator.

I felt that life would be really perfect (for a

(*Continued on page* 452)

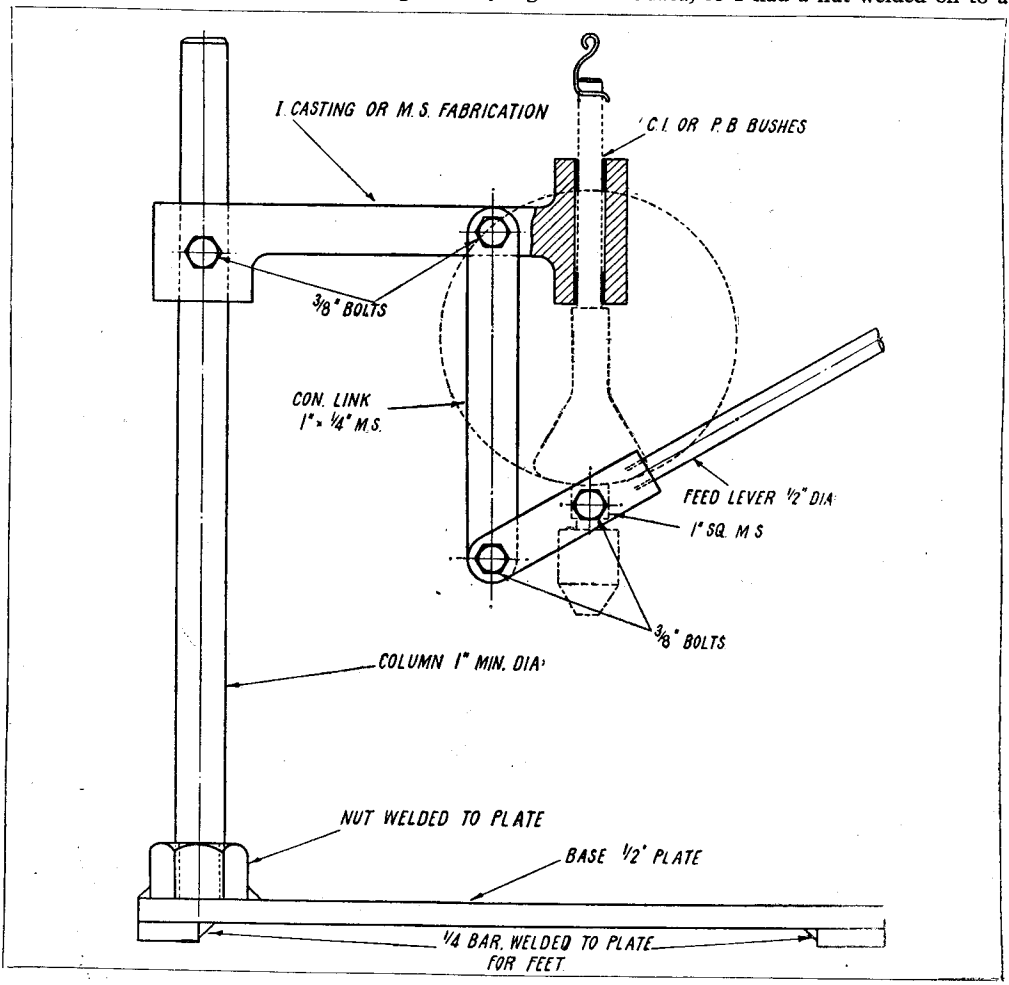
A ½-in. Capacity Bench Drill

by T. Leightwood

WHEN I saw the big 2-speed breast drills in the tool shops I thought my drilling troubles were over. The one I bought was nicely built, and, with its ½-in. chuck, I expected to do almost any reasonable job with it. But, in practise, I found, first, that any drills less than 3/16 in. diameter bent in the most sickening manner, and anything more than ¼ in. seemed to turn without bothering to cut in steel, even with a pilot hole, so I was little better off than before.

However, I decided that some form of leverage had to be used, and if I could erect the machine vertically on a stand, I could drill holes " square " and use all my energy to feed the drill to the work.

At the factory where I work, there are a number of pneumatic drills, and the workmen who use them have a stand consisting of a slotted bar, to which is firmly fixed a column about 1½ in. diameter. An arm, locked by a set-screw, can be set in any position about this ; the stand can be set up over the hole to be drilled, the machine mounted in it, and a screw mounted in the machine concentric with the drill, giving the necessary thrust. One of these on a scrap heap gave me an idea, so I had a nut welded on to a piece of ½-in. plate that I found alongside it, and some ½-in. bar for feet, as shown in the drawing. The column was screwed in position by holding the column in the vice and turning the plate.



I cut the arm down and had a short piece of 1½ in. diameter bar welded across the end. This should be at least 3 in. long, to be of much use, as the drill point is rather a long way from the lower bush. A ⅝-in. hole is drilled (or bored) parallel to the existing hole and two bushes

turned externally to a tight fit in the hole, and internally bored to a sliding fit on the rod of the drilling machine. As these bushes are rather thin-walled, phosphor-bronze is safer than cast-iron, although iron bushes would last better.

All that remains to do to this part is to drill and tap a hole, for the ⅜-in. bolt, on which the connecting-link swings. This hole can be anywhere from 2 in. from the bushes right back to the clamping bolt for the column, but the position shown on the drawing is the best in my opinion.

The connecting-link should be long enough to have the lever horizontal when the machine is halfway down its vertical travel, the top hole being a neat ⅜ in. diameter while the lower one is a tapped hole.

As the feed lever and the connecting-link must be free to move, all 3 bolts concerned are fitted with locknuts to hold the bolts tight in their tapped holes, the bolts being tightened till they just nip the "free" member, then the nut is tightened on the bolt which should just leave the "free" member free to move without being too loose.

The feed lever consists of a long ½ in. stud and an old key. The key was cut down, drilled and tapped, and, holding the stud in the vice, was screwed on to it with a spanner. The two ⅜-in. holes are 2¼ in. apart, and are also a neat fit on the shank of a ⅜-in. bolt.

One point in favour of this type of lever is that although the lever is quite short and doesn't get too much in the way, an extension can easily be slipped over the end for the extra leverage needed for big holes. However, should it be preferred, a flat lever of the same material as the connecting-link can be used instead.

All that remains now to be added, is a means to lift the machine to the top of its vertical travel when the feed lever is released.

This can be done by either springs or balance weight. Springs of sufficient strength require quite a long rod to permit enough movement to suit most needs, and although I used them for a while, the weight system is the best; there is a much longer stroke, and none of the gradual increase of resistance of the springs.

For simplicity, one pulley fixed immediately above the machine is enough, with the weight hanging down beside the cord to the top of the machine.

Finally, a word on mounting. Set the machine on the *left-hand* corner of the bench. In this position the machine can be swung over the end of the bench for drilling the ends of long jobs, e.g. centring shafts. A plate, similar to the base-plate of the stand, could be bolted for this purpose to the side of the bench, although this is not strictly necessary.

"Fowlers" — A Concerto for Two

(*Continued from page* 450)

time) if I could only be up with the driver on that footplate. As I had already made friends with him by promising to send him a snap of his engine, my request was granted, and there I was surveying that wondrous motion from the stalls. She was a double-crank compound with Stephenson's link motion and there was 180 on the clock. The engine, as a whole, appeared to be in excellent condition and the young driver (in his early 20s) was genuinely attached to, and interested in, his massive charge; a most refreshing discovery for these days, and he told me it was a grand life!

Suddenly my examination was brought to an abrupt end by a most melodious toot on No. 1's whistle—our signal. It was now time for us to play our part in this thrilling concerto, this symphonic poem in steam. Accordingly, the lever controlling the drum was now engaged and the throttle given the usual jerk, but only a gentle one just to pick up the slack in the cable and to turn the cultivator round. Then a few more jerks on the throttle and a slight canting of the whole engine as we took the strain of the tines tearing up the earth; a quickening of the tempo and a most awe-inspiring series of crashes from the chimney. This was grand, the whole huge monster was trembling with sheer brute force, and those cranks were turning over at a really smart clip.

I cannot help feeling that the simile of an orchestra is really most applicable; we have the conductor (driver) standing in front with his hand on the baton (throttle) and those gleaming crossheads shooting backwards and forwards, surely they are reminiscent of the slides of the trombones. As for the movement of the tops of the Stephenson links, you just couldn't think of anything else but the agitated bowing of the violins. Then, of course, we have the drum emulated with similar exactitude by that mighty exhaust! As for the tune, well for a true lover of steam the noise really is most pleasing.

As it was not a very large field, the throttle was now eased back and then closed, with the cultivator coming to rest just by our side, altogether a very interesting and satisfying performance. After this effort I noticed the steam gauge had dropped about 10 lb., indicating hunger in the vitals of the great beast. The fire door was opened and I was surprised at the comparatively calm fire which was disclosed, just a mass of red coals, no spectacular flames. Only about four shovels of slack and lumps were needed, but what a lovely column of black smoke they produced. Meanwhile, the implement was being towed back by No. 1, and No. 2 was put in gear and shifted a few yards up the field ready for the next drag. Then, for the first time, the injector was put on; these compounds appear to be most economical on fuel and water—they must run on their reputations!

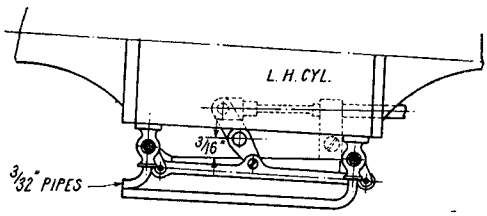
At this moment my wife came along and led me quietly away; she's a very understanding soul.

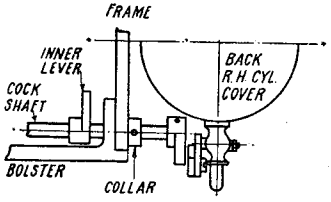
At the end of the field we joined the car and I took a last look round. There, just breasting the slope, was a copper cap, and a column of black smoke opposite gave the position of his pal.

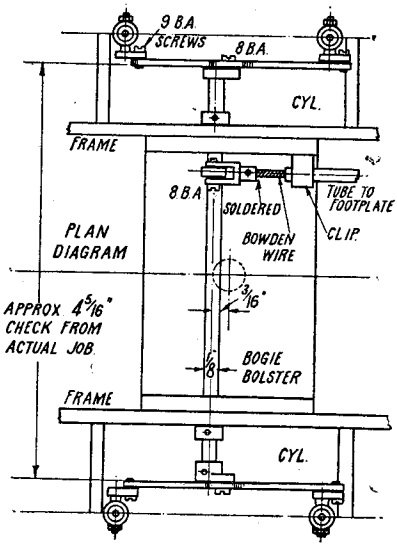
A 3½-in. Gauge L.M.S. Class 5 Loco.

by "L.B.S.C."

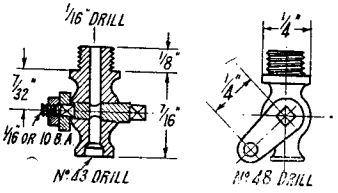
YOUR humble servant had a bit of a job to scheme out a satisfactory arrangement of cab-operated drain cocks for the cylinders of the little "Class 5" engine, the "can't scale Nature" business being the chief cause. Whilst some full-sized engines have ordinary plug-cocks, others have small poppet-valve gadgets operated by a push-rod, whilst others have cocks with parallel sliding plugs working like a piston-valve. The plug has a groove in it, and when this lines up with the steamways through the cock body, it allows the steam and water to blow past to the outlet pipe. When the solid part of the plug is slid between the steamways, naturally it closes the "entrance to the way out." Whilst these cocks are easy to make, and need only a fraction of an inch lateral movement to open and close them, it is a fiddling job to get the weeny plugs steam- and water-tight, yet perfectly free to operate. The also-weeny poppet-valves are very fond of performing the sticking-up antic, as it only needs a speck of dirt on the seating, to cause a blow. Either type, in a size to be workable and absolutely reliable, would be far larger than "scale"; so on weighing up the pros and cons, I thought it would be best to use our old friend the taper plug cock. This merchant can't play the usual stick-or-leak tricks, as the plugs get plenty of lubrication from the cylinders; and the cocks can be made small enough to avoid being unsightly.



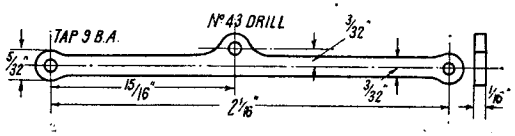




Arrangement of cylinder drain cocks



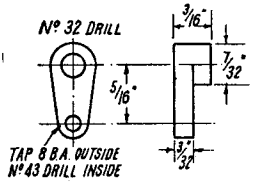
Details of cocks



Cock connecting-rod

Connecting the cocks to the operating lever in the cab, was another trouble, on account of the length of rodding involved. If connected as on the big engines, the rod would have to be in several sections with a hanger at each joint, otherwise it would simply have buckled on the "push" movement; and a long continuous rod would have needed intermediate bearings or bridles. However, Sir H. N. Gresley got over the same trouble in full size by using a Bowden wire; and what was good enough for that much-lamented eminent engineer, is good enough for me, so we can fix a cross-shaft underneath the

cylinders, and connect the operating arm on it by a Bowden wire with the bottom of the lever in the cab. There is no need to use the Bowden casing, which is much too clumsy for our purpose; just get a bit of the wire itself from your local cycle-dealer, and run it through a piece of brass tube. I've just been trying a short length in a piece of thin-walled brass tube 3/32 in. outside diameter (the Bowden casing is $\frac{3}{16}$ in. diameter) and it works very well.



Adjusting levers

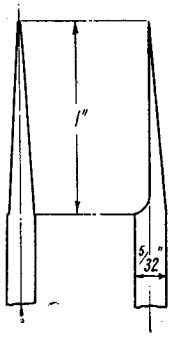
How to Make the Cocks

For the benefit of beginners, here is a brief summary of how to make little plug cocks. The novice's trouble is to turn a taper plug that will fit the hole in the body of the plug-cock and work easily, yet be perfectly steam- and water-tight. I solved that problem over 45 years ago, when I had my first $3\frac{1}{2}$-in. Drummond lathe. The specification said that the headstock was made to set over, so that (for example) small taper cock-plugs could be turned, and the holes bored exactly to the same taper. Well, I tried it, but somehow it didn't work out that way! The cock bodies wanted some setting up for cross boring; and the sort of boring-tool used for holes 3/32 in. diameter at the small end, was only suitable for use in a watchmaker's high-speed lathe. On a light cut it chattered; if fed quickly or deep enough to avoid chattering, it broke. Also, unless the boring and turning tools were set "to mike measurements" in a manner of speaking, with a surface gauge, the internal and external tapers came out at different angles, and wouldn't fit for toffee-apples. Anyway, I wasted no more time, but went to work as follows. I chucked a bit of round silver-steel a little bigger than the largest diameter of the cock-plugs, turned a taper on it, filed away half the diameter of the tapered part, and hardened and tempered it to dark straw, finally giving the flat face a rub on the oilstone. Then I turned up about a couple of dozen bits of brass rod, same diameter as the largest end of the cock-plugs, to a taper at the end, *without altering the lathe setting, nor the tool, in any way whatever.* As both reamer and plugs were turned with the same tool, and same setting of the lathe, it stands to reason that the plugs would be a perfect fit in holes made with the reamer, and so it proved. I have always made cock-plugs that way. If I need more than I have turned after making the reamer, the slide is reset to the degree I used for that job.

For the drain-cock job on the "Class 5," chuck a bit of 5/32-in. round silver-steel, and turn a cone point on it 1 in. long. Serve it as stated above. To temper; rub the flat part on a piece of fine emery-cloth or similar abrasive—don't spoil the cutting edges—then hold a bit of sheet-iron over the domestic gas stove, with the reamer on top. As soon as it turns yellow, tip it off into some clean cold water. Rub on the oilstone, and you're all set. Turn a taper on the ends of half-a-dozen pieces of 5/32-in. bronze or gunmetal rod about $\frac{3}{4}$ in. long. Don't turn to a point, leave the end about $\frac{1}{16}$ in. wide; and whatever you do, don't alter the setting of the slide-rest.

Turn the cock-bodies from $\frac{1}{4}$-in. round bronze or gunmetal rod. Chuck in three-jaw and turn $\frac{3}{16}$ in. length to $\frac{3}{16}$ in. diameter; screw $\frac{3}{16}$ in. by 40, then face off until the screwed part is $\frac{1}{8}$ in. long. This ensures full threads to the end. Make half-a-dozen whilst you are at it, parting each off $\frac{7}{16}$ in. from the shoulder. Then chuck a short bit of rod about $\frac{3}{8}$ in. diameter; face, centre, drill 5/32 in. or No. 22, countersink the end slightly, tap $\frac{3}{16}$ in. by 40, and skim off any burrs. Screw each blank into this, and turn the outside as shown in the illustration. Centre the end, drill through with $\frac{1}{16}$-in. or No. 53 drill, and counterbore the end slightly with No. 43 drill, to take a bit of 3/32-in. pipe.

Cross-drill the bulge in the middle with 5/64-in. or No. 48 drill, and be sure the hole goes right across the "equatorial line" and doesn't wander sideways towards the tropics of Cancer and Capricorn. I have seen plenty of commercial plug-cocks which were apparently drilled by somebody with a bad squint. When drilling on the machine, I use a bit of rod with a $\frac{3}{16}$-in. tapped hole in the end, for a handle, and rest the cock-body in a dint made by a $\frac{1}{4}$-in. cycle-ball in a bit of hard wood; mightly simple, but very effective. Put a tap-wrench on the end of the reamer, and ream out the cross hole until



Cock reamers

one of your plugs will enter, and project about 5/32 in. the other side.

Chuck the plug by the parallel part, and turn the end to $\frac{1}{16}$ in. diameter for 3/32 in. length; screw $\frac{1}{16}$ in. or 10-B.A. Directly after this, file a square on the plug, just long enough to enter the cock-body about 1/32 in. when the plug is right home. This allows for grinding-in. Part off the plug so as to leave 5/32 in. projecting at the large end; then file a 3/32-in. square on that end, to accommodate the handle. To hold the taper plug whilst filing this square, chuck a bit of brass rod $\frac{3}{16}$ in. diameter or larger; face, centre, drill down a little way with 3/32-in. drill, then ream it taper with the cock reamer in the tailstock chuck. Push each plug tightly into the taper hole,

and it will hold quite tight enough to allow the square to be filed in the manner I have described so often, that most folk should be able to do it with their eyes shut.

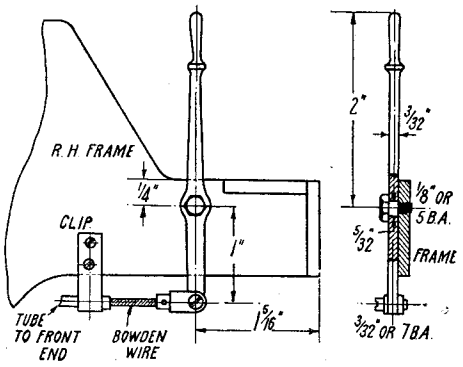
The handles are filed up from $\frac{1}{16}$-in. by $\frac{3}{16}$-in. steel strip, and need no detailing ; fit each to a square on the plug, and two or three taps with a hammer will burr the edge of the square sufficiently to prevent the handle coming off. Put each plug in place with a commercial nut and a $\frac{1}{16}$-in. washer (file the hole in this square, naturally, to fit the square on the plug) then screw the cocks temporarily into the holes in the cylinder flanges, marking which is which, on the cock handles. Then set the handles back 45 deg. as shown in the illustration. Take the cocks out without shifting the handles ; put the tapped bush in three-jaw, screw each cock into it, and run the $\frac{1}{16}$-in. drill up the bore, right through the plug. Take out the plugs, silver-solder a bit of 3/32-in. pipe into each cock (get the length from the actual engine) but don't bend it yet. Grind the cock-plugs in with a scraping off your oilstone ; just a few turns back and forth should be all that is needed. Clean the plugs well with a spot of paraffin, and poke out the steam ways in both plug and cock body ; then replace plugs, smearing a taste of cylinder oil, or a little graphite (off a soft blacklead pencil will do), leaving the nuts so that the plugs work easily. Finally, screw them into the cylinders with a weeny bit of plumbers' jointing on the threads, then bend the pipes as shown in the illustration.

Operating Gear

The cocks may, of course, be merely connected by a 0000-gauge coupling-rod between the two handles, and operated " at ground level " as desired ; for footplate control, proceed as follows. Make up the little connecting-rods from a bit of steel strip, to the dimensions shown ; a simple filing and drilling job. A cross-shaft will be needed underneath the cylinders, so drill a No. 30 hole in the position indicated, through the frame at each side ; these holes will pierce the flanges of the bogie bolster, but that doesn't matter an Assouan. Note : this location—$\frac{3}{16}$ in. ahead of the centre-line of the bolster, and $\frac{3}{16}$ in. from the bottom of frame—won't do for anybody who has used a built-up bolster, as there will be a big nut in the middle, right in the way of the shaft. In that case, drill the holes a little farther forward, between the next pair of bolster screw-holes, and alter the position of the lugs on the rods connecting the cock handles, to a like amount. That will put things O.K. and the working will not be affected.

The shaft is a piece of $\frac{1}{8}$-in. round silver-steel approximately $4\frac{5}{16}$ in. long ; check this off from the actual engine by putting the connecting-rods temporarily on the cocks, and measuring the distance between them. This shaft carries three arms or levers, two for operating the cock-rods and one for connection to the lever in the cab. One lever is just a plain flat doings filed up from 3/32-in. by $\frac{1}{4}$-in. flat steel, and drilled as shown ; press this on to one end of the shaft, and braze it in place. The other two have bosses which are fitted in precisely the same way as described for valve-gear suspension-levers and the like, viz. brazing on a small solid boss and then drilling through the lot with the boss held in the three-jaw. The small end of the inside arm is drilled No. 43 to accommodate an 8-B.A. screw in the fork operating it. Two small collars are also needed, to prevent any side movement of the shaft when erected ; see illustrations. These should be drilled a tight fit for the shaft, say No. 31.

To erect the shaft, just remove the connecting-rods from the cock handles ; put a collar on the shaft, and poke the end through the hole in the



Operating handle

frame on one side. Put on the lever with the plain drilled end, push the other end of the shaft through the other hole in frame, put on the other collar, and finally the other lever. Line all three levers up, so that the end holes are both in line and the middle directly opposite ; push the collars against the frame at each side, so that the shaft cannot move endwise, then pin the collars and the levers to the shaft. I use bits of blanket pins for jobs like these ; a No. 57 drill is just right for a nice drive fit. Big pins are not needed ; and, anyway, if you drilled a hole for a $\frac{1}{16}$-in. pin in a $\frac{1}{8}$-in. shaft, it would soon break at the hole. I've seen plenty of this sort of error in the commercial jobs I have rebuilt, back in the days when I could find time to do them.

You will probably have to make the screws, as they should have a plain section under the heads, for the cock handles to take a bearing on ; this is dead easy, as it only means chucking a bit of $\frac{1}{8}$-in. round steel in three-jaw, turning down the end for about 5/32 in. length, and putting a few threads on with a die in the tailstock holder. The threads should be a tight fit, and when screwed right home, the cock handles should be quite free to move. Couple up the connecting-rods to the cock handles, then put an 8-B.A. screw through the middle hole each side, into the lever on the end of the cross-shaft. Note again—as the cross-shaft levers are longer, from centre to centre, than the cock handles, the hole in the middle of the connecting-rod must be filed slightly oval, to allow for the difference in the radial movement. All four cocks should move perfectly freely, when the inner lever is operated with your fingers. Don't screw up the nuts on the cock-plugs so tight that they will be hard to turn, or scoring will result, and you'll get the old stick-and-blow trouble.

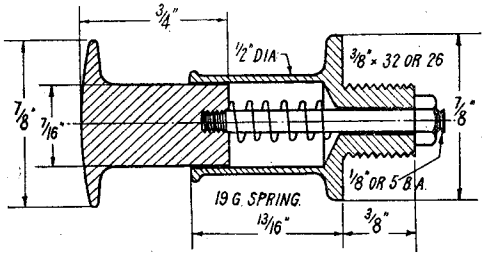
Cab Lever

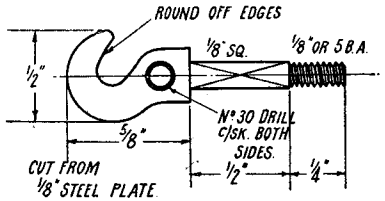
The cocks are " remotely controlled " by a lever in the cab, connected as previously mentioned, by a Bowden wire, to the inside lever on the cross-shaft. The lever is a plain filing job, the handle being either turned solid with it, or turned up separately from $\frac{1}{8}$ in. round steel, and brazed on to the flat part. Drill a No. 41 hole at the bottom, and a 5/32-in. hole 1 in. above it. Turn up a hexagon-headed screw from a bit of $\frac{1}{4}$-in. hexagon steel rod, leaving a full $\frac{1}{8}$ in. of " plain " under the head, turned to a working fit in the 5/32-in. hole in the lever. The end is turned down to $\frac{1}{8}$ in. diameter, and screwed $\frac{1}{8}$ in. or 5-B.A.

At $\frac{1}{4}$ in. below the top of the right-hand frame, at $1\frac{5}{16}$ in. from the drag-beam, drill a hole in the frame with No. 40 drill, tap to match the screw and file off any burr. Attach the lever to the inside of the frame as shown ; when the screw is tight home, the lever should move without any side-to-side movement. Make up two little forks or clevises, same as I described for valve gear work, from 7/32 in. or $\frac{1}{4}$-in. rod, drilling the stems $\frac{1}{16}$ in. Measure the distance by the nearest route, between the bottom of the lever and the end of the middle arm on the cross shaft, both being vertical. By " nearest route " I don't mean a straight line, but the nearest way that misses the location of the bottom of the firebox, and any other obstruction. Cut the Bowden wire about $\frac{1}{2}$ in. shorter than this, grease it well, and thread it through a piece of 3/32-in. brass treblet tube, or any other thin-walled tube that it will fit easily. The tube should be about 1 in. shorter than the wire. Fix the two forks at either end of the wire ; solder the wire into the stems, and if desired, you can put a set-screw in as well. Couple up the forks to the arm of the cross-shaft and the lever, by screws as shown ; these should have a plain part where they pass through the levers, one side of the fork being clearing size, and the other tapped for the screw. Then set the tube so that it clears all obstructions, and secure it at each end by two little clips made from about 18-gauge sheet brass. If the clips tend to move or slip on the tube when the lever is operated teach them good manners with a touch of solder. The location of the clips, is shown in the illustrations. The cocks should now work freely by moving the lever back and forth, the lever staying wherever it is placed, merely by friction alone. No stops are required—you'd be puzzled to miss the " on " and " off " positions !

Buffers and Drawhook

The above completes the working parts of the chassis, with the exception of the steam brake gear ; but as this is optional, and can be fitted at any time, I propose to describe it after the boiler is made and fitted, and the engine has been on the road. Then those who don't wish to bother about brake-gear on the engine, won't be delayed. It looks all right, and works all right, but is practically useless as an actual brake in $3\frac{1}{2}$-in. gauge size. As any full-size driver will tell you, a passenger engine pulls the train, but the train stops the engine, in a manner of speaking, the continuous brakes acting on all wheels of the train. In $3\frac{1}{2}$-in. gauge, an effective hand-brake on the driving car is the most satisfactory means of stopping ; applying brakes to the engine wheels would only cause them to slide, or " pick up," as the enginemen call it. A " scale " brake application, in which the brake-block pressure was sufficient to lock the wheels, would be about as effective with a dozen passengers up as putting your toe under the wheels of " Princess Polwolly-galatzi " dropping down Camden bank into Euston with an 18-coach load. Incidentally, the brakes on the " Maid " and " Minx " can be used for their legitimate purpose, as the engines are bigger and heavier ; we'll see about those later on.





Details of buffer and drawhook

Meanwhile, any builder of " Doris " who has caught up with the notes and is stuck for a job, can make the buffers and drawhook to the dimensions shown in the illustrations. No detailed instructions are needed ; both are simple exercises in turning and filing. The buffer sockets may be made from castings, or turned from the solid ; I usually turn and screw the shank, part off to length, then screw the embryo socket into a tapped bush held in three-jaw, for turning the outside to correct profile, and drilling for pin and head. The heads are turned from round mild-steel rod. I had a bit of rustless steel of correct diameter, which I used for the buffer heads of " Grosvenor " ; but, holy smoke—*was* it tough ? I'm saving the rest of it to use for pistons, if I build any more locomotives ; I'm sure they would never wear out ! As to the drawbar hook, just mark it out on a bit of $\frac{1}{8}$-in. steel, and saw and file to outline ; don't forget to round off the nose of same, so that it doesn't cut the coupling shackle, or Inspector Meticulous will be having another excuse to pop down to the " local " ! All being well, I will describe the L.M.S. type of screw coupling later on, with the " trimmings."

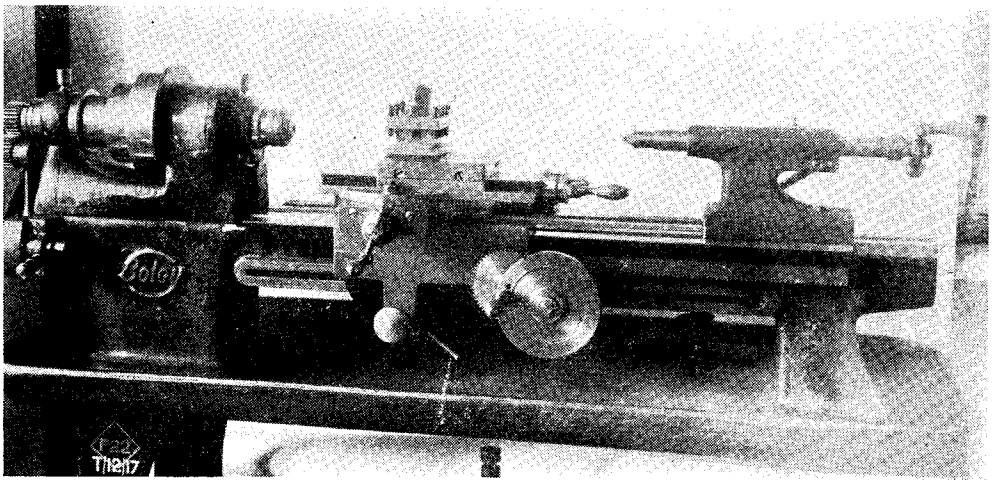
Reconditioning a "Boley" Lathe

by K. N. Harris

I WAS fortunate enough recently to come into possession of a 90-mm. "Boley" screwcutting lathe. This lathe had seen seventeen years of hard toolroom service, and during its latter years had been sadly neglected and used as a hack lathe for shops boys.

When I got it, it was in a sorry state and a depressing sight.

However, a tool of this character has basic accuracy built into it, and, provided nothing is actually smashed, can not only always be reconditioned, but restored practically to its original accuracy; and, furthermore, this is well worth doing; at any rate, it is worth doing for the amateur, for a new lathe of this class would cost at least £400 today.



Perhaps a description of the lathe will be of interest here.

The centres are 90 mm., say 3½ in., and it will take 18 in. between centres quite comfortably.

The bed is a clever adaptation of the Boley single-geared plain precision lathe bed, which is of the form shown in Fig. 1.

In the screwcutting lathe, this form is maintained in its essentials, but the through slot is done away with and two wing shears are added to carry the saddle. See Fig. 2. This gives a very wide and stable bed and provides a perfect housing for the leadscrew, which is central and completely protected from chips and swarf. It entails a special form of carriage or apron which passes right under the bed like a hammock and is fastened to the saddle on either side. The saddle has a solid gib on the front side, but at the rear is a parallel taper wedge-piece capable of adjustment.

"Parallel taper" sounds a contradiction in terms, but what is meant is that its sides are parallel in vertical section, but the whole strip tapers along its length. It is supported at its thinner end by a pin fixed in the saddle, the strip being slotted to fit over it and allow of longitudinal adjustment, which is carried out by a screw with a large cheese-head, partly sunk in a recess in the strip and screws into the end of the back-strip of the saddle.

It may be of interest to compare the dimensions of this saddle with those of the lathe of the type built for the amateur market. The length of the saddle is 8⅛ in., the width of the bed is 6¼ in., and the bearing area of each gib is over 8 sq. in. These figures compare with 4 in., 3 in. and 2 sq. in. respectively for a 3½-in. lathe of popular make.

In giving these figures, I am in no way decrying the type of lathe in question; it is excellent value, and, used intelligently, will produce first-rate work, as the pages of THE MODEL ENGINEER bear abundant witness. It has to be built to a price; metal costs money, and machining it costs more, and these facts strictly limit what it is possible to do in making a cheap lathe.

I record these figures, not to deprecate the cheap lathe, but to give some idea of the difference between such a lathe and the high-class precision article, and to show some of the reasons for the large difference in cost.

To revert to the carriage: this, as stated, passes right under the bed. In the centre is mounted the clasp-nut, the two halves of which move horizontally and are actuated by a lever moving in the horizontal plane. At the front is a steel knob.

When the lever is moved towards the headstock, it closes the clasp-nut and a spring catch locks it. Pulling the knob instantly releases it, and a powerful spring opens the clasp-nut. It is very handy in use.

A rack is fixed under the front shear of the bed and a pinion gears with this, and is carried on a shaft running in a bush in the apron or carriage. On the outer end of this is mounted a balanced handle. In my opinion, this is bad piece of design and construction. For one thing, rotating the

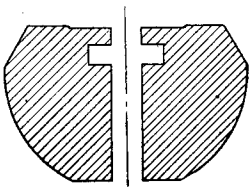


Fig. 1

handle clockwise moves the carriage *towards the headstock* and vice versa ; in other words, you are " turning against the travel " ; a more serious fault is that this arrangement gives far too large a movement of the saddle for one turn of the handle, actually around 2¼ in., and precludes the use of the rack for hand feed. I shall probably be told that this is not intended for use as a feed, but I personally like so to use it, and do so constantly.

The headstock is, when one considers that the lathe is only of around 3½ in. centres, quite hefty, and the mandrel has a clear bore of ⅝ in. It is, of course, fitted with drawbar, and the nose itself takes the collets directly. The outside of the nose is normal and a protecting cap for the thread is part of the standard equipment.

The bearing arrangement is unusual ; both bearings are coned and of the dead-hard steel type, the rear one is of the double-cone type, the journal being separate and adjustably mounted on the mandrel, the steep angle cone taking thrust towards the tailstock (as arises, for instance, in cutting a left-hand screw), the adjustment is by means of two fine thread lock-nuts and the journal bush is restrained from turning by a key. The front bearing is a single cone, the journal, of course, in this case being the mandrel itself, and hardened. Thrust towards the headstock (e.g. as in drilling) is taken, or I should say, *was* taken, by a ball-race ; this will be referred to later.

The cone pulley takes a 1¼-in. flat belt and has three steps, 2¼ in., 3½ in. and 4¾ in. diameter.

It is locked to the mandrel for direct gear by a spring-loaded plunger which drops into a key-way in the mandrel passing through a slot in the gunmetal back-gear pinion sleeve.

The plunger is operated by what looks like a large slot-headed screw in the face of the middle step of the cone pulley. This is really a short crankshaft, the pin of which operates in a recess in the plunger and lifts it out of engagement, against the pressure of the spring when back gear is wanted. Half a turn of the " screw " serves to lift or release the plunger.

The back gear itself is orthodox in principle but unusual in the way it is applied.

It is mounted entirely between the cone pulley and the front bearing and is, practically speaking, totally enclosed. The layshaft, of the eccentric type, is mounted below the mandrel and is operated by a small knurled knob projecting through the front of the headstock, whilst a lever at the rear serves to lock it either " in " or " out."

The driving pinion is, as already stated, of bronze, whilst the other gears are of steel ; they

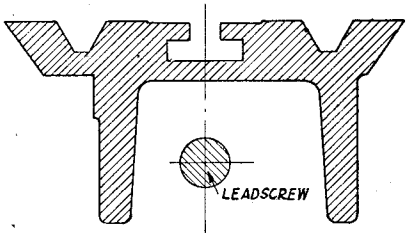


Fig. 2

are wide and of comparatively fine pitch, and they run so smoothly and quietly that by ear one cannot tell that back gear is engaged. The ratio is unusually low, about 3½ to 1, as against the more normal 6-7 to 1.

This, in my opinion, is an advantage, as it leads to an evenly-spaced speed range with no big gap between lowest " direct " and highest back-gear speed.

Lubrication is by wick-feed oil cups, and though these are placed on top of the headstock casting, they feed to the bottom of the bearings, the correct place. The point of inlet of oil should always be somewhere in to 6-9 o'clock quadrant of the bearing, looking from the tailstock end.

The headstock casting itself is robust and excellently designed to get the maximum strength with the minimum material, nothing is skimped, but there is no waste. The bearing housings are, of course, solid, and the hardened bushes a press-fit in them. Just behind the mandrel nose collar is fitted a felt ring to retain oil and exclude swarf and grit.

In studying the whole design, it is abundantly obvious that sound mechanical principles and efficiency were the ruling factors, with cost a secondary consideration.

The headstock takes its bearing on the centre-ways of the bed (in fact, the " wings " for the saddle finish just ahead of it) and is held in position by two tee-headed bolts and eccentric shafts.

The tumbler reverse is unusual, inasmuch as it moves the whole quadrant. It is mounted on a bracket which has its axis concentric with that of the lead-screw. The lead-screw itself is 5 mm. pitch " Acme " form.

The tailstock takes its bearing on the centre portion of the bed and is locked in position by means of a tee-bolt, operated by an eccentric shaft and back lever. The barrel is graduated in millimetres and has about 100 mm. travel ; it is bored for No. 2 Morse, but is not self-ejecting. The locking device is interesting, as it is obviously designed to avoid any possibility of pulling the

barrel out of correct alignment. Fig. 3 shows the principle.

The tailstock has a set-over adjustment and the back is graduated. The upper portion is guided across the lower by a groove fitting over a

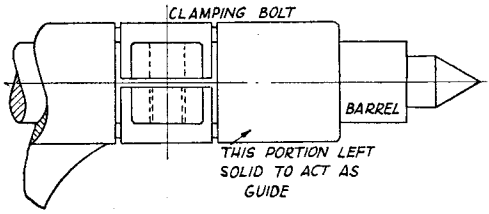


Fig. 3

tongue at right-angles to the axis. This feature is somewhat unusual in a precision lathe.

The compound slide-rest is a most substantial affair with a very long cross-slide and a top-slide with 4½ in. travel. The top-slide swivel base is 5¾ in. diameter graduated in degrees and will swivel around 360 degrees. It is fastened by two bolts.

The cross-slide handle travels with the slide, the top-slide handle does not. Both have friction-tight adjustable indices graduated in 1/20 mm.

The top-slide has a delightful mechanical contrivance to cover the feed-screw. In the upper surface of the gantry on each side of the feed-screw slot is machined a very shallow recess (a bare 10 thou. deep).

The underside of the moving slide which carries the nut is shaped as shown in Fig. 4, and a strip of thin spring steel is passed through the slot in the nut as shown; one end is fastened to the front of the gantry by a countersunk-head screw and the other tucks into a slot in the block which holds the feed-screw in place.

As the slide moves backwards and forwards, the strip passes through the nut like a wave. The strip is graduated in mm. Outwardly there is nothing to show how it works and there is no

(*Continued on page* 465)

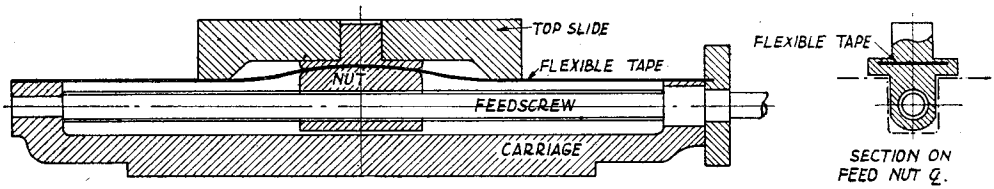
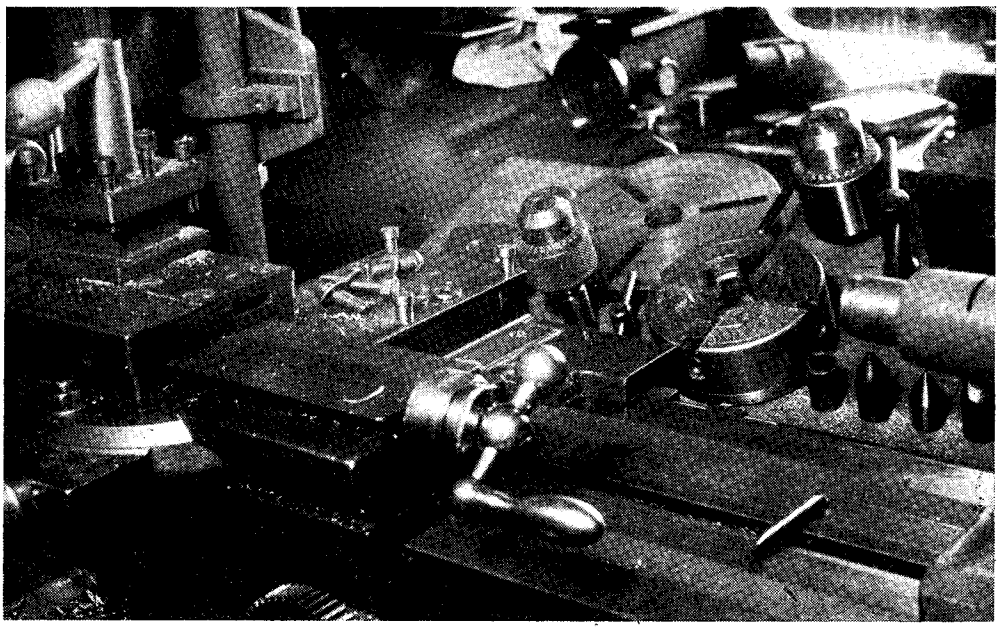


Fig. 4



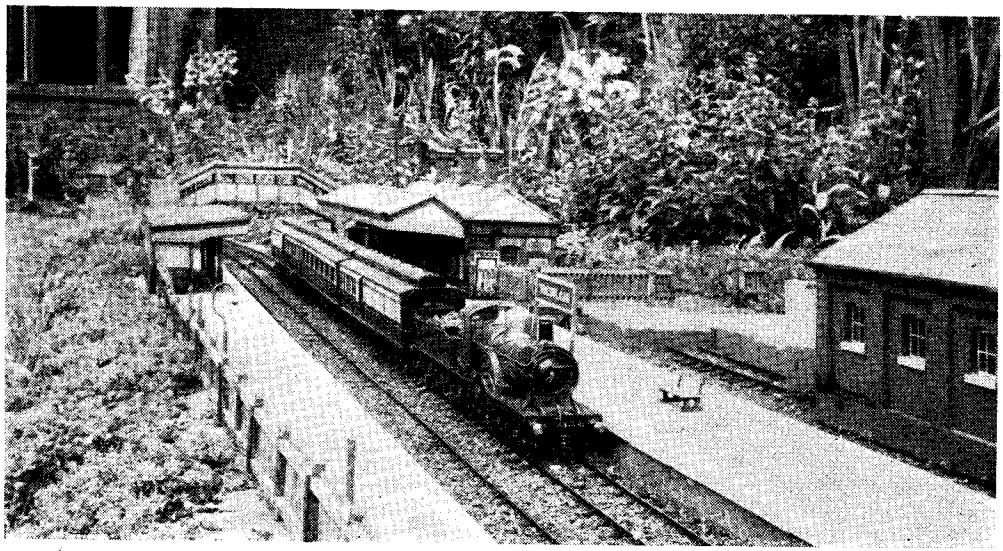
Close-up of top slide and 4-way turret. Note apparently solid top slide, detailed in Fig. 4

G.W.R. REDIVIVUS

by J. N. Maskelyne, A.I.Loco.E.

MR. A. P. WHATLEY, of Blackheath, is one of the oldest friends of THE MODEL ENGINEER, and his name will be found in past issues, from time to time, extending back over a period of more than forty years. His interest has always been primarily in steam-operated garden railways, and he has had considerable experience in this particular branch of model engineering.

Meanwhile, Mr. Whatley had built a 1½-in. scale Southern Railway "Lord Nelson" class engine, which, although it looked very nice, never did a great deal of running; for, not long after this, a great change was made. Not that the line itself was altered, but the idea behind it was considerably modified. The old G.W.R. was taken definitely as the prototype for everything on the line, and Mr. Whatley decided that future loco-



General view of Tresulgan Station

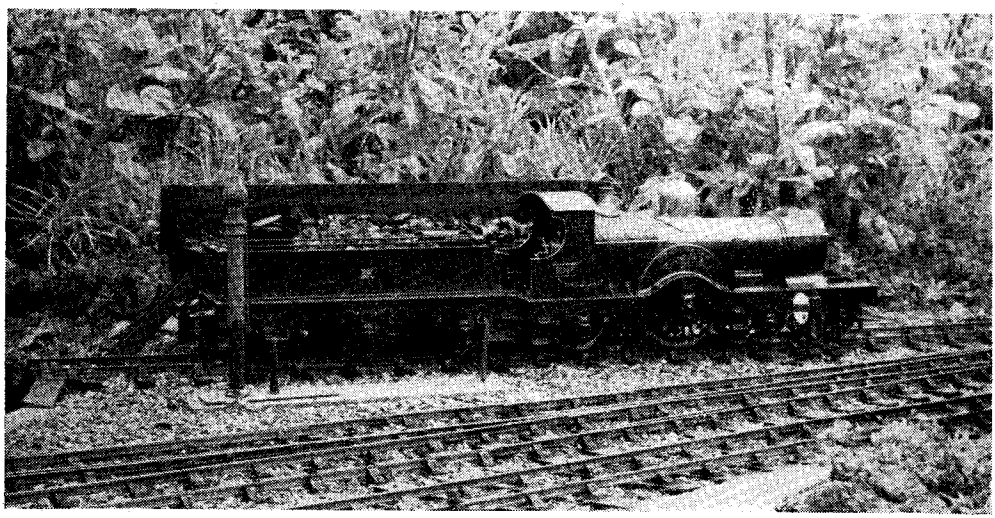
Practical activities began many years ago in the construction of a free-lance, 2½-in. gauge 4-4-0 type engine, some rolling stock and a track in the garden. A station, signals and other accessories were built and added, in due course. The results were excellent and long-lasting, instructive and entertaining. The maintenance of the track, of course, required constant attention, due to the vagaries of the weather; but, provided that repairs were done regularly, no serious trouble was experienced. The track itself was in the form of a single-line circle with a passing-loop, sidings, etc. at the station.

Removal to another home, in due time, involved taking up and removing the railway to a new site. This time, the layout consisted of a single-line straight road laid along one side of a beautiful old-time garden. There was a station at each end, with appropriate sidings; but at one end there was also a goods yard, locomotive depot and carriage siding. The buildings and all other relevant details were scale replicas of G.W.R. practice of about the 1895-1900 period and represented typical country stations of the time.

motives should be to that railway's design. The ½-in. scale was abandoned some time before, and 17/32-in. scale adopted. Mr. Whatley built several wagons and vans, all typically "Swindon" in appearance, and a train of three very handsome and supremely characteristic clerestory coaches. These things so exactly suited the scenic features of the railway, including the station buildings, signals and other details, that the then future locomotives would *have* to fit into the scheme.

Accordingly, an order was given to H. P. Jackson, of York, for a 17/32-in. scale, coal-fired model of the 4-2-2- engine No. 3046, *Lord of the Isles*, built at Swindon in 1897. This model was fully described and illustrated by Mr. Jackson in THE MODEL ENGINEER for October 15th, 1936; on the track she is astonishingly powerful for a single-wheeler, though, due to coal-firing in so small a size and on a purely "scenic" line, she is somewhat awkward to control.

About two years later, Mr. Jackson built a spirit-fired 4-4-0, No. 3439, *City of London*, which, in appearance, is as faithfully correct



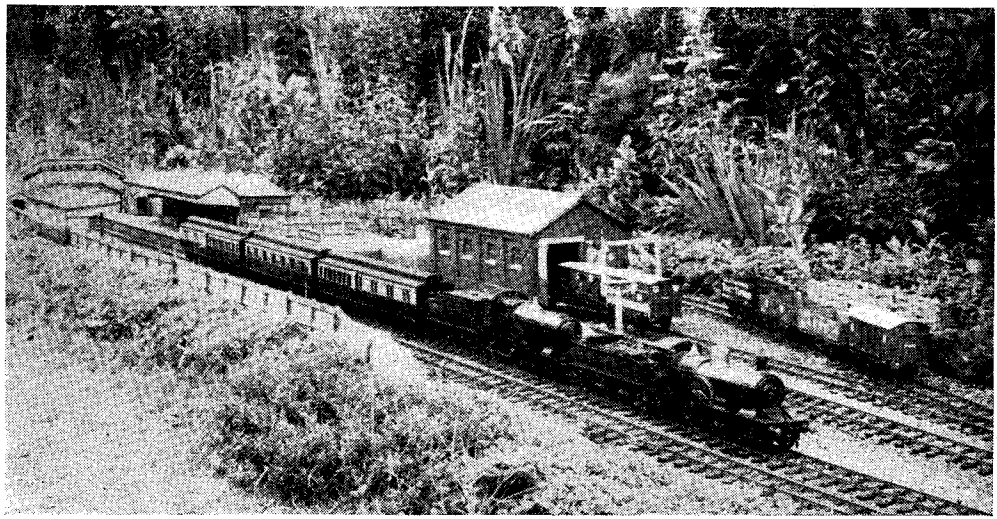
"Lord of the Isles" taking water

as the single-wheeler, but the spirit-firing makes for more satisfactory control. This engine was illustrated on page 258 of THE MODEL ENGINEER for September 15th, 1938.

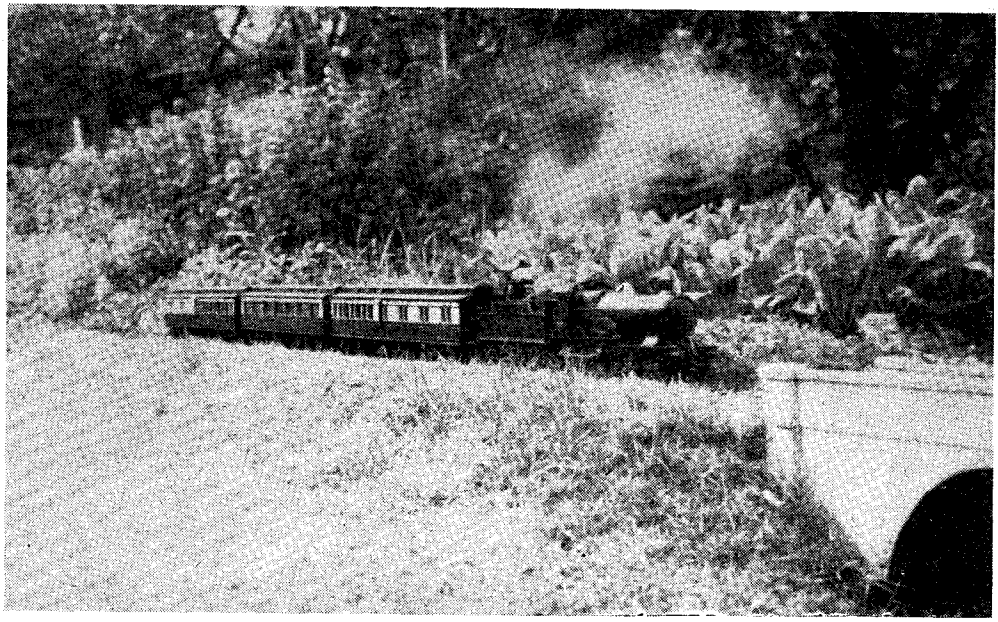
These two engines worked upon the line until the outbreak of the war in September, 1939. In due course, Mr. Whatley's house and garden suffered considerable damage through bombing, but fortunately he, his family and the models escaped injury.

After the war, a new home was found nearby the previous one ; in fact, the new garden actually abutts on to the old one. When the aftermath of the removal had been overcome, Mr. Whatley set about the reconstruction of his railway on the new site, and has busied himself with it, in his spare time, for about two years. The plan reverts to the single-line circle scheme, but the one station, "Tresulgan," provides a long passing-loop, straight for practically the whole of its length, on the main line. A carriage-siding, goods-yard, locomotive depot, etc., are once more installed as of yore, and everything is once again in working order.

Recently, I spent a most enjoyable afternoon, in spite of very wet weather, watching it all once more. Between the rain-squalls, I took some photographs, a few of which are reproduced herewith ; I hope they will speak for themselves. To me, however, the most fascinating feature



"Lord of the Isles" and "City of London" double-heading a train leaving Tresulgan Station



" City of London " and train approaching the viaduct. Note the exhaust steam

of this line is the old-time " atmosphere " of it. It recaptures the G.W.R. I remember in my boyhood days ; there is not a single jarring feature, and above all, it is an object-lesson in how to arrange a model railway without spoiling a lovely garden.

At the time of my visit, the " City " was steamed and ran beautifully, without trouble of any kind. Mr. Whatley is contemplating the conversion of the single-wheeler to spirit-firing, to make her more fitted to work trains on this most attractive railway. All the same, I posed her for some of my photographs ; but the " City " was in steam all the time, and in one shot is seen actually running, the cloud of exhaust steam being clearly visible.

For the Bookshelf

How to Draw Technical Illustrations. By A. T. Linsley and G. J. Hawkins. (London : The Studio, Ltd., 66, Chandos Place, W.C.2.) Price 3s.

The type of technical illustration dealt with in this handbook is the " pictorial " or perspective drawing, such as is very extensively used in catalogues or technical articles, and is recognised as one of the most difficult forms of draughtsmanship. It calls for a combination of artistic ability with complete technical knowledge of the subject, but the results undoubtedly justify the pains taken, as this form of drawing is particularly pleasing and provides the most lucid explanation possible, particularly if semi-sectional or " exploded " views are employed. There may be some doubt as to whether work of this nature can ever be learnt from a book, and there is no doubt that the most essential factor in artistic ability is innate rather than acquired ; nevertheless, the authors have done all that is possible in describing the methods employed, and in giving some excellent examples of illustrative work, from the simple to the complex. Angles of lighting, methods of shading, the use of mechanical " tints," and wash-drawing and scraper-board technique are also described.

Build your own Projector. By W. G. Rowell. (Cineluxe Ltd., 1,725, London Road, Leigh-on-Sea, Essex.) Price 12s. 6d.

The construction of cinematograph projection equipment is of interest to many model engineers, and this subject is very fully discussed in the above handbook. It describes the essential features of modern sub-standard film projectors, both " silent " and " sound," also component details such as intermittent movements, optical systems, sound heads, and illuminants. The author appears to have a sound grasp of the practical requirements in construction of apparatus with the limited equipment of the amateur workshop, and little difficulty should be experienced by the competent worker in producing a successful projector from the information provided in the book.

ARALDITE

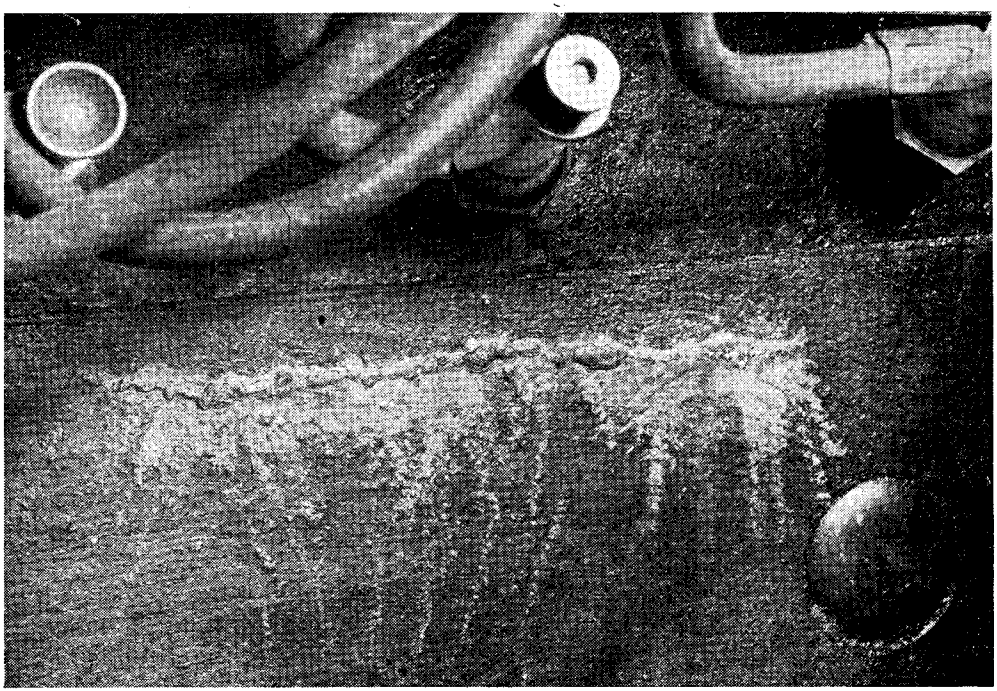
by T. A. Brown, F.Fr.Ae.S.

ARALDITE is a thermo-setting bonding agent,which ensures technically sound joints such as are effected by riveting, welding or soldering. It was originally developed by Messrs. Ciba Limited, Basle, for use with light alloys, but it will also unite with steel, iron, ceramics, glass and other materials, such as thermo-setting plastics, which will tolerate the heat required when curing the joint. Aero Research Limited, of Duxford, Cambridge, are marketing this resin in Great Britain.

It is supplied in two forms, rod and powder, and can be obtained in two colours, silver or light brown. The purpose of the silver resin is to give a metallic appearance to the joint when a bond is made between metals. This silver form, however, is rather more viscous than the natural or light brown type, and is, therefore, not quite as suitable as the latter when penetration into a crack or close-fitting joint is desired. Araldite silver is correspondingly more suitable when a close-fitting joint cannot be ensured, and gap-filling properties are required.

Because of its low viscosity at high temperatures Araldite will penetrate into the finest cracks in a similar manner to solder. It is quite thin-bodied at 120 deg. C., spreadable at 90 deg. C. to 100 deg. C., " doughy " at 40 deg. C. to 50 deg. C. and solid at room temperatures, while prolonged heating in excess of 120 deg. C. will start the curing or setting action. Curing times vary according to the amount of heat applied, and this clearly depends on the sensitivity to heat of the materials to be bonded, and also the method used to supply the heat. Provided that precautions are taken against excessive local over-heating, a bare flame such as a blow-lamp may be used, though a modern type of domestic oven or a thermostatically controlled oven is more suitable in some cases. Glass, for instance, obviously requires a slow, uniform, controlled heat. Curing times vary between 10 min. at 240 deg. C. to 2 hr. at 180 deg. C., but special care must be taken when temperatures in excess of 220 deg. C. are used.

The method of application of Araldite depends on the type to be used, and the task to be accomplished. The rod form is best applied by pre-heating the surfaces to be bonded to between 100 deg. C. and 120 deg. C. The resin will then melt and flow on contact with the heated surfaces,



A cylinder block repaired in position by Araldite, cured with a blowlamp

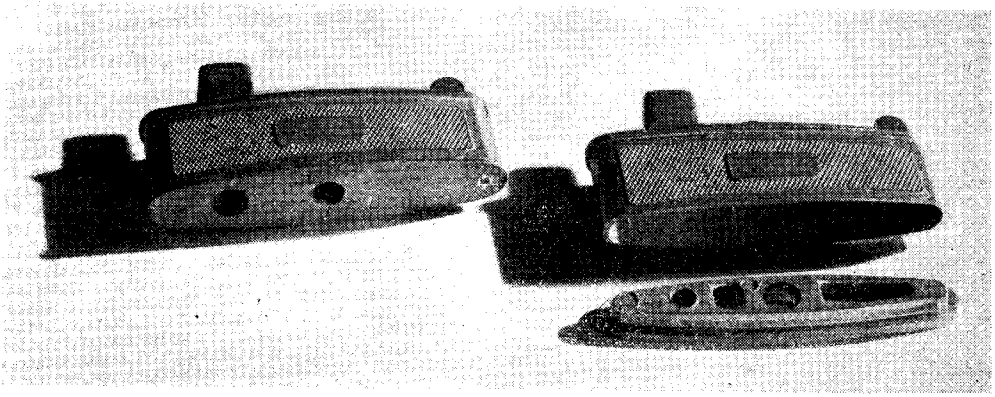


Photo by courtesy] [*Messrs. Macfarlane Arthur & Co. Ltd.*
This design for a cigarette lighter utilises the resistance of Araldite to solvents such as petrol. The diecastings are shown separately (right), and (left) after bonding

and penetration will be facilitated. The same method should be used for the repair of cracks. The best form of application for the powder form of Araldite is by dusting on to the surfaces, but it should be ensured that sufficient powder is being added to avoid starving the joint of adhesive.

An Araldite bond has several characteristics that will ensure many applications in industry. It is resistant to all common organic solvents, and to either hot or cold water. It does not cause corrosion, has no smell or taste, and is innocuous. It can be anodised when used as a bond for light alloys, and during the setting process experiences practically no change in volume. Non-porous materials are easily bonded, since no water or volatile substances are split off whilst hardening, thereby removing the usual difficulties associated with this type of joint. One important point to remember is that all surfaces to be bonded must be cleaned free of dirt, oil and grease, but they do not require to be roughened.

Storing does not present any outstanding difficulty, though, as might be expected, the resin should be kept in a cool dry place that is not exposed to direct sunlight and heat. Under these conditions it has a very considerable shelf life.

Practical tests on the capabilities of this adhesive have been carried out by Aero Research Limited.

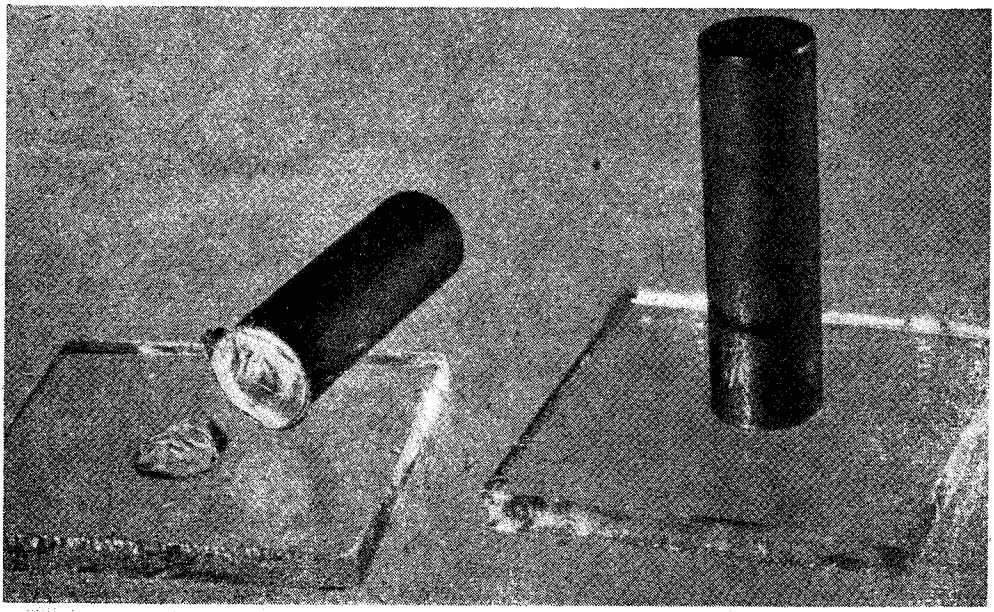
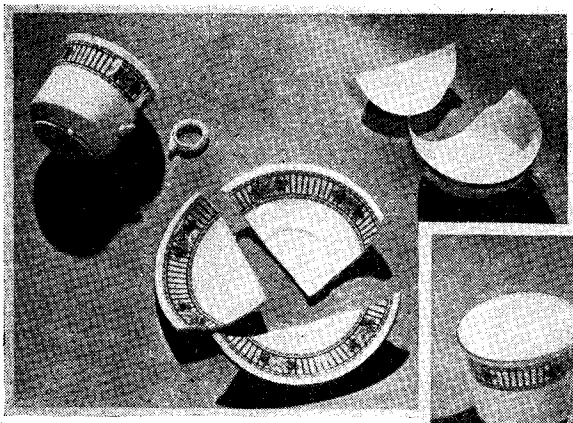
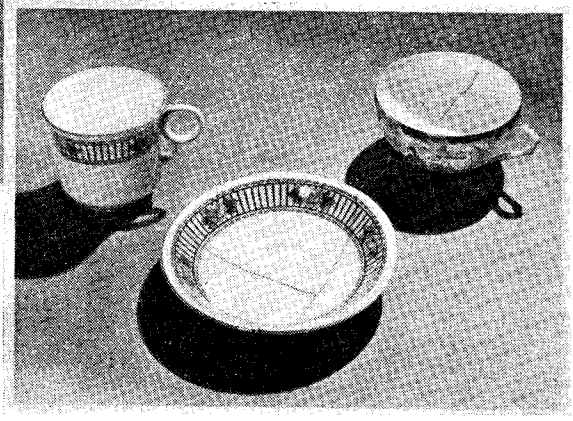


Photo by courtesy] [*Aero Research Ltd*
A test on a glass-to-metal bond in which the joint remained intact, yet a piece of the glass has been plucked out

These included the repair, in position, of the cracked cylinder block of a car engine; the curing being carried out by means of a blow-lamp. The strength of this form of bond, however, was most strikingly demonstrated during the course of a test in which the end of a metal bar was bonded to the face of a glass sheet; the glass-to-metal bond remained intact, yet a portion of the glass was plucked out, leaving a concavity.





Photos by courtesy Aero Research Ltd.

Araldite, cured for two hours at 180 deg. C., has been used to repair these pieces of broken china

Reconditioning a "Boley" Lathe

(*Continued from page* 459)

obvious and visible connection between the slide and its operating screw. Mr. Gentry described a similar device, but without the graduations, many years ago. The steel strip is about 0.0060 in. thick.

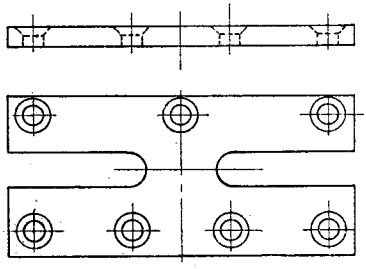


Fig. 5

There is an excellent feature for carrying whatever form of tool-post is required. This consists of a double-slotted steel plate, see Fig. 5, screwed by countersunk-head screws to the slide top. All the direct strain comes on this, and it is not only renewable, but spreads the stress evenly over a large area of the slide and practically eliminates any possible risk of distortion. A really good three-point fixed steady, with lock-nuts on the adjusting screws and lock-bolts on the plungers, forms part of the equipment. A substantial cast-iron tray, fitted on heavy frame legs of such a height as to bring the lathe to a reasonable level, is included, together with a two-speed countershaft, driving cone and belt-shifting gear.

Accessories include 23 changewheels, 24 collets from $\frac{1}{16}$ in. to $\frac{3}{8}$ in., expanding ring holding collets, various centres, male, half and female, a back toolholder to mount on cross-slide. Driving plate, faceplate, Cushman four-jaw independent, a three-jaw s.c. chuck and a lot of oddments were all included.

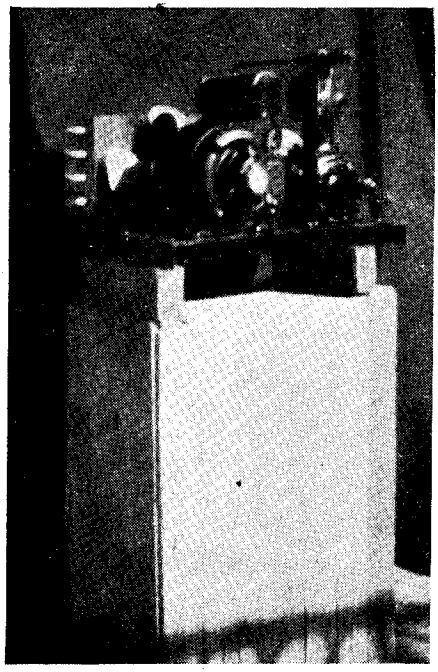
The first job was to strip everything down, right to the last nut, bolt and grub-screw. I found enough trouble to make the angels weep, but I was agreeably surprised to find that, generally speaking, the "guts" were in sound condition Damaged screws, missing screws, loose handles, missing keys, hammer and saw mark burrs, dents, and every conceivable form of superficial damage and neglect, but nothing fundamentally wrong.

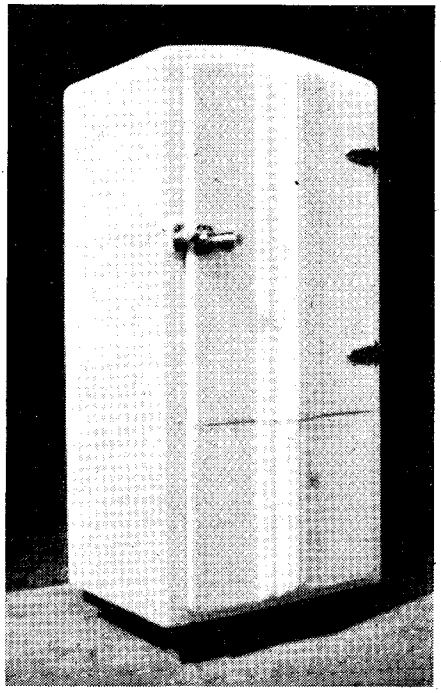
(*To be continued*)

Editor's Correspondence

A Successful Home Refrigerator

DEAR SIR,—I trust that the photographs of the home refrigerator which I have constructed will prove of interest to readers. This machine has been in use for some 18 months and was made in accordance with the instructions of your contributor, Mr. Mayland Smith, in THE MODEL ENGINEER in July and August 1945. The compressor is of my own construction, including the patterns and castings.





The machining was all done on a 3⅜ in. Zyto lathe which has now been disposed of. The compressor unit seen in one of the photographs is not the one incorporated in the machine, but has been made with a view to installation in a second refrigerator, one of these days. The machining of this was carried out on a 3½-in. Myford type Drummond which is now in my possession, and it incorporates certain improvements of detail.

It may be of further interest to remark that I am a baker by profession and have had no instruction in engineering practice, except what I have been able to pick up from technical publications, such as THE MODEL ENGINEER.

Yours faithfully,

Balham. ARTHUR R. FARMER.

"Support Home Industry!"

DEAR SIR,—In reply to the letter by Mr. George L. F. Bonnette, I do not agree with his contention that this matter has gone beyond control, or that it is too late to give the true craftsman the recognition which he deserves in competitive model sports. The latter cannot be truly compared with full-size motor-car and motor-cycle racing, because these sports give considerably more scope for the skill of the operator, and interest in the technical side of design and construction is a comparatively minor consideration. How much technical interest, for instance, is displayed by the average dirt track devotee? On the other hand, the racing model spends the decisive part of its career outside the control of the operator, and thus, the competitor is mainly banking on his technical skill as a designer and constructor; without this additional stimulus, model sport must necessarily become monotonous and uninteresting. One of the greatest attractions at any model power boat regatta or model racing car meeting is the variety and individuality exhibited in the various models; a feature which is depressingly absent when only commercially-made engines and component kits are employed in constructing the models.

Mr Bonnette states that there have been cases where the home-built entry of today has become the commercial proposition of tomorrow. (I would go still further and say that practically every important development in the design of racing models has been pioneered by the amateur ; perhaps those who differ from me in this opinion would be interested to make up a list of those which have not !) But surely this only constitutes an even stronger reason why the interests of the amateur should be protected—if only to keep the manufacturer supplied with new ideas free of charge !

Mr. Bonnette suggests, that, to be consistent, I should ask for special marks for competitors in the MODEL ENGINEER Exhibition who make their own tools. While this has not been a specific policy in the judging of exhibition models, it may be of interest to observe that the facilities of individual constructors, in so far as they are known, have always been taken into consideration by the judges in assessing the merit of the models.

I am not worrying a little bit about the readiness of the craftsman to pit his own brains or the work of his hands against commercially-made products, even though the scales are heavily loaded against him ; it is for the future that I am mainly concerned. Many an enthusiast with the potential ability to become a craftsman may be deterred from embarking on construction of his own model by the lack of a definite incentive to do so ; and everyone will be the worse off as a result, not the least being the individual concerned. It is true that those with the creative urge and the love of craftsmanship in their souls will always continue to make models, but they will tend to shun the competitive type of model—as indeed, many are beginning to do even now—and this again would be a dead loss to everyone. By all means let the amateur constructor and the user of commercial models or components compete "on equal terms," as Mr. Bonnette suggests—but let us go a little deeper than the mere superficial interpretation of this phrase.

Yours faithfully,

Surrey. EDGAR T. WESTBURY.

Club Announcements

The North London Society of Model Engineers

We have at last obtained premises suitable for a workshop. The society has several pieces of machinery which will, when installed, prove a blessing to many members whose own equipment may not be very extensive.

Our next general meeting will be on Friday, November 5th, at the offices of the Barnet District Gas & Water Co., Station Road, New Barnet, at 8 p.m.

Hon. Secretary : N. M. DYER, 97, Selborne Road, N.14 (Palmers Green 2414).

Croydon Society of Model Engineers

Forthcoming meetings of the above club are :—

October 28th. Boats Night by Wilson & Co.

November 11th. Competition.

November 25th. Film Show on model engineering topics.

December 9th. Rummage Sale.

Hon. Secretary : J. F. STRINGER, 59, Windmill Road, West Croydon.

West London Model Power Boat Club

The last club event of the 1948 season will be a round-the-pond race on October 31st, at the Round Pond, Kensington Gardens. Will all members do their best to attend and make a good display for the end of a successful year.

Although there will be no more competitions this year, there will be plenty of craft on the water each Sunday. Visitors will be welcomed and may rely on being shown something interesting.

Hon. Secretary : G. E. FIDLER, 174, Oxford Gardens, N. Kensington, W.10.

The Northampton Society of Model Engineers

The winter season of lectures opened with considerable success on Thursday, September 23rd, with Edgar T. Westbury as the speaker ; the subject being "The History and Development of Model Petrol Engines."

Further lectures are as follows :—

November 18th. E. Bowness. "The History of the Sailing Ship, 1840-1940."

December 16th. S. J. Ward. "Then and Now."—Contrasts between the *Cornwall* and the *Duchess of Buccleuch*.

January 20th. W. J. Bassett-Lowke. Film show, "Celluloid Memories."

February 17th. A. R. Peers. Subject not yet decided.

These lectures are taking place at the Northampton College of Technology, St. George's Avenue, Northampton. Non-members are cordially invited to attend, and although there is no charge for admission, tickets must first be obtained from the Hon. Secretary.

Hon. Secretary : W. A. WELLS, The Guest House, Moulton, Northants. Phone : Moulton 3265.

Edinburgh Society of Model Engineers

The annual general meeting of the above society will be held in the club room, 1a, Ramsay Lane, Off Lawnmarket, Edinburgh, on Saturday, October 30th, at 3.30 p.m.

An attractive programme has been drawn up for the ensuing season and new members will be made very welcome.

The club room is open on Tuesday evenings at 7.30 p.m. and Saturday afternoons from 3.30 p.m.

Hon. Secretary : James H. FARR, Wardie Garage, Ferry Road West, Edinburgh, 5.

Eltham and District Locomotive Society

The next meeting will be held on November 4th, at the Beehive Hotel, Eltham, when the designs for the new trolleys will be discussed. The society's permanent track is progressing favourably, and the steelwork will be commenced shortly. Several new members have recently been enrolled and the society is expanding rapidly.

Entries are now being received for the Crozier Locomotive Challenge Cup, the test and trials which take place next year.

Visitors are always cordially invited to the meetings.

Hon. Secretary : F. H. BRADFORD, 19, South Park Crescent, Catford, S.E.6.

Merseyside Live Steam and Model Engineers

The following programme of lectures will be held in the clubroom, 12, Shaw Street.

November 10th. "Strength of Materials and Some Design Calculations for the Model Engineer." J. Benn.

November 24th. "Model Boat Building." F. C. Lloyd.

December 8th. "Cutting Tools and Cutting Angles." J. P. Williams.

December 22nd. "The Gentle Art of Turning." J. P. Williams.

January 5th. "Marine Diesel Engines." J. Hamilton.

A hearty welcome is extended to visitors, and particulars of membership may be obtained from the Hon. Secretary, A. F. DUCKITT, 145, Bowring Park Avenue, Liverpool, 16.

The Buxton Model Engineering Society

The above society will hold its annual exhibition in the Hardwick Square School Rooms on Friday and Saturday, October 29th and 30th. On Friday the doors will be opened at 2 p.m. and on Saturday at 10 a.m. Closing time on both days will be 9 p.m. Will members of other societies who visit us please make themselves known.

Hon. Secretary : L. M. HOBDEY, Westward Ho !, Lightwood Road, Buxton, Derbyshire.